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Abstract

Governments, business leaders, educators, students, and parents realize the need to inculcate a culture of lifelong learning – learning that spans geography, time, and lifespan. This learning has both formal and informal components. In this chapter, we examine the conceptual basis upon which informal learning is defined and some of the tools and techniques used to support informal learning. We overview the rapid development in information and communications technologies that not only creates opportunities for learners, teachers, and researchers but also challenges us to create equitable and culturally appropriate tools and contexts in which high-quality, continuous learning is available to all.

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Introduction

Before we examine the ways that informal learning is transformed by digital contexts, we must understand what “informal learning” means. Unfortunately, the term has been used by many authors over many years to stand in for a variety of different and sometimes contradictory ideas, approaches, and activities, a fact bemoaned by many (e.g., Eraut, 2004; Livingstone, 2001; Rogoff, Callanan, Gutiérrez, & Erickson, 2016; Schugurensky, 2000).

As Colley, Hodkinson, and Malcom (2002) wryly observed, many authors simply define informal learning as “not formal.” Others attempt contestable definitions, for instance, described informal learning as unstructured, experiential, and non-institutional, begging the question as to what structured, non-experiential, and institutional learning might be, and ignoring the fact that informal learning also occurs in institutions. Schugurensky (2000) identified three forms of informal learning: (1) self-directed learning in which a learner acts with intention and awareness of their learning objectives to acquire specific and usually self-defined knowledge competencies; (2) incidental learning in which learning occurs outside of the intent of the learner, but they are conscious of the newly acquired knowledge; and (3) socialization, in which one acquires knowledge without intent or even awareness that they are learning. However, these can occur in nonsocial learning, too, and all such ways of learning also occur in formal settings, so it still fails to identify what is distinctive. Eraut (2004) sees dimensions of implicit, reactive, and deliberative learning that broadly equate to Shugurensky’s socialization, incidental, and self-directed categories, but, as he noted, there is a fuzzy continuum between formal and informal that admits many exceptions and where counterexamples can easily be found. Though recognizing the problem, Eraut sidesteps resolving it.

We believe that the fuzziness of the term’s application is due in part to a common failure to adequately explain what is meant by *formal learning*. Formal learning is easily recognized in its most archetypal forms as what takes place in educational institutions. However, much learning in formal settings occurs that is hard to describe as formal, enabled through encounters in corridors, inadvertent modelling of roles in the classroom, or discussions in canteens. The lines dividing formal and informal can be hard to discern even at a structural level. Is in-service training formal? Or taking part in a MOOC? Or taking piano lessons? Does it make a difference if those lessons result in grades certified by a government, an academy or by a private educational company? Some authors have used the term *non-formal* to characterize kinds of learning that appear to straddle the borders of formal and informal, but this negative definition simply evades the issue. Further confusion often arises through confounding informal learning with related but orthogonal terms

such as *self-directed learning*, *self-regulated learning*, *lifelong learning*, *incidental learning*, *implicit learning*, and *tacit learning*, all of which may occur in a formal as well as informal contexts.

In the absence of clear defining characteristics, formal learning may better be characterized using Wittgensteinian family resemblances: common traits that may, individually, be shared by informal learning but that, in sufficient numbers, allow us to characterize the learning as more or less formal. Formal learning tends to be externally regulated: frequently in process, nearly always in goals. It usually involves rites of passage such as enrollment, progression, and certification. Formal learning usually follows timelines, rules, customs, and norms. There is often some social or external sanction involved, most notably in the form of certification, not just of learners but of their teachers, textbooks, and institutions. Formal learning often involves rituals – specified or normal ways of doing things. Formal learning normally has a purpose, often expressed as goals, objectives, or outcomes, and is nearly always intentional. The presence or absence of any of these characteristics does not define learning as formal but, when enough of them occur together, it usually is.

Informal learning may also be recognized by clusters of family resemblances. Informal learning is typically self-directed and self-regulated. It may, however, also emerge through shared practices, interests, or goals within a group or network of people (such as those in a workplace or club) or simply through acting in the world. Much is incidental, the result of performing an activity or practice in which learning is not the primary goal but a side effect of doing something else. There may be occasions when informal learners actively seek knowledge, tuition, or guidance, or where they may intentionally perform an activity in order to learn, but it is often just-in-time and short-lived. There are seldom extrinsic measures or rules for it to follow. It is rarely timetabled. It is often open-ended, without a clear beginning or end. Informal learning may occur at any time and any place, including during a formal learning event. Any of these characteristics may occur in a formal learning setting, too, but a large-enough cluster of resemblances leads us to describe it as informal.

Informal and formal learning are not mutually exclusive categories: they lie on a continuum, with much fuzziness at the boundaries. Within a learning trajectory that might, as a whole, be characterized as formal, we may engage in much learning that is not, observing things around us, engaging with others and making connections between ideas at times and places far removed from a formal setting. Similarly, formal elements may play a role in informal learning, as a catalyst, sometimes as a component of it and, sometimes, as we shall see, as a means of certifying it.

To help distinguish more clearly between them, we characterize the learning spectrum from informal to formal as having two distinct but related dimensions: incidental (intentional) and self-directed (dependent) (see Fig. 1). We note that the halfway point between self-directed and dependent is mostly occupied by social ways of learning, in which we are co-participants, both directing and being directed by others.

Table 1 provides some illustrative examples of values for each of the dimensions for a range of learning activities, noting that these are highly contingent, depending on many contextual, personal, and pedagogical variables that may lead to different

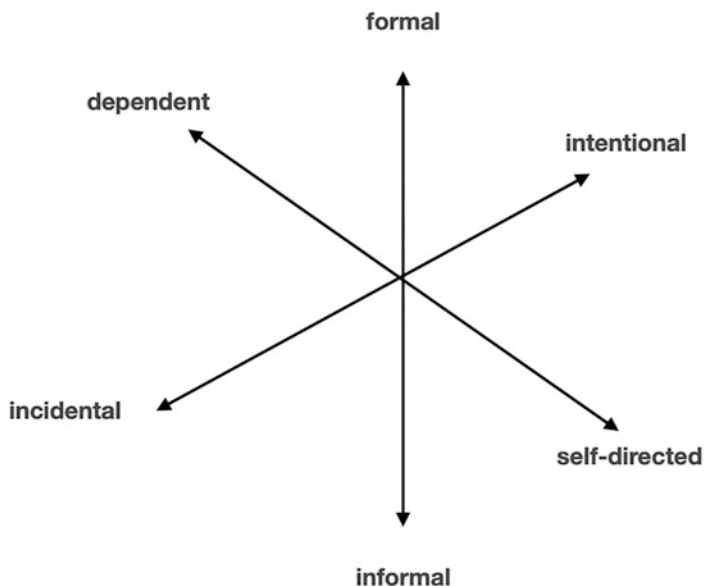


Fig. 1 Related dimensions of formal and informal learning

Table 1 Examples of applying the informal learning dimensions

Learning activity	Informal/ formal	Intentional/ incidental	Self-directed/ dependent
PhD study	Largely formal	Intentional	Largely self-directed
Improving skills on an instrument while learning to play a tune	Informal	Fairly incidental	Self-directed
Practicing scales	Fairly informal	Intentional	Self-directed
Attending a lecture	Very formal	Very intentional	Very dependent
Following a YouTube tutorial	Informal	Intentional	Fairly dependent
Learning while chatting in a cafe	Very informal	Very incidental	Partly self-directed
Performing a problem-based exercise set by a tutor	Formal	Intentional	Fairly self-directed
Learning how people in a discipline think by attending a lecture and observing the lecturer's attitude (the hidden curriculum)	Formal	Incidental	Largely self-directed

categorizations under different conditions. A learner's trajectory over the course of a sustained learning activity may take them through any or all of the dimensions of informality, intentionality, and self-directedness at different times as well as, occasionally, simultaneously.

Digital Contexts Are Different

It has been claimed that, when Einstein was asked for his telephone number, he looked it up in a phone book, observing “Why should I memorize something when I know where to find it?” Our “phone book” today is many billions of times bigger than Einstein’s paper catalogue. There are few facts that cannot be found within seconds, as well as countless fictions, half-truths, and abject falsehoods. Equally, we can connect with countless millions of other people. In pre-digital times, we inhabited one environment at a time and learned through our interactions with it. Now, we inhabit many environments between which we can switch at will, and much of the time, our actions are recorded, our interactions are reified, and the things we share may persist indefinitely. We are thus not just dwellers in these environments but active creators of them. Digital learning is different, and so are our learning needs as we have less need-to-know information but instead know where to find it and what to do with it.

The abundance of connections and seemingly limitless availability of information enabled by the Internet has both created new opportunities for learning as well as a greater need for it. We are not enjoying the ease and luxury of idle time as expected by early technology proponents. As the Red Queen in *Through the Looking Glass* put it, “it takes all the running you can do, to keep in the same place. If you want to get somewhere else, you must run at least twice as fast as that!” (Carroll, 1871). This is a necessary feature of technological change. Technologies build upon and from other technologies (Arthur, 2009), and each new technology creates new adjacent possible empty niches (Kauffman, 2019) for newer technologies to fill. Thus, technological growth follows an exponential curve and has done so over many millennia.

In order to “run faster” today, we must be able to access and use more knowledge, become better or differently skilled, and be more motivated to learn. Formal learning that occurs episodically, usually early in life, and that is often removed from its context of application, is not enough. Worse, students are often rewarded for learning as instructors intend and punished for failing to do so, especially through grades and credentials, which can reliably sap away any intrinsic motivation that learners may feel to learn more (Kohn, 1999; Ryan & Deci, 2017). Informal learning that is chosen, or incidental to other things we choose to do that can occur at any time or place, is inherently motivating, meeting needs for competence, autonomy, and, in most cases, relatedness, which are the three cornerstones on which intrinsic motivation depends (Ryan & Deci, 2017). Combined with the cornucopia of knowledge and connections with others that the Internet provides, informal learning is well positioned as the primary means to achieve lifelong learning. However, there is a Faustian bargain to all technologies (Postman, 1998). With each problem a technology solves, new problems are created.

The Darker Sides of Digital Technologies

The abundance of learning opportunities in cyberspace can be overwhelming and threatening rather than inviting participation in informal learning. Social overload

(McCarthy & Saegert, 1978) was first measured in real-life contexts in which demands of social interaction strain and stress individuals. Although much online informal learning takes place in nonsocial contexts (such as an information search on Wikipedia), systems like Reddit, social networks, and MOOCs use both human and technological inducements to motivate learning. Such systems may create psychological stress in which the perceived demand for reciprocity, desire for social attention, or other social responsibilities become stressful and can lead to abandonment of the learning projects. Cognitive overload occurs when the learners' cognitive, memory, or temporal restrictions preclude effective processing, storage, and utilization of that information (Roetzel, 2019). Systems overload occurs when the complexity of the systems – especially related to overabundance of features and options – impairs learners' cognitive abilities and more importantly their learning efficacy (Fu, Li, Liu, Pirkkalainen, & Salo, 2020). The abundance of information, with no guarantee of consistency, veracity, or efficiency in support of learning, may also lead learners to confusion or inaction. Thus, provision of opportunity itself and pressure from both live peers and motivational algorithms can hinder as well as motivate informal learners.

Though individual motivation is critical, it is not the only factor limiting learning and receiving benefits from that learning. Social factors including fairness, self-efficacy, opportunity, financial resources, time, and support also impact an individual's capacity and agency for successful learning. Issues of access to hardware and network connectivity for informal learning become increasingly important both for individuals and families and for government policy (Boyadjieva & Ilieva-Trichkova, 2018). Equally, the skills to effectively use ever-changing tools become a new learning hurdle (Iordache, Mariën, & Baelden, 2017).

Without guidance by experts and without all the resources available in institutions, informal learners using the Internet may sometimes face insurmountable barriers and difficulties. Without the continued filtering, critical thinking, expert help, process support, and resources of formal learning, informal learners may pursue false or unfruitful paths, may fail to see important aspects of what they are learning, may stumble when faced with resource or cognitive barriers, and may wander without a rudder in a sea of conflicting opinions, truths, half-truths, and lies.

In the rest of this chapter, we provide some thoughts and recommendations for introducing many of the benefits of informal learning into a formal setting and approaches to informal learning that reduce some of the risks.

Informal Learning in a Digital Context

Social Informal Learning

Much learning is social in nature. We acquire new knowledge and skill by asking questions, observing and copying behaviors we see demonstrated by others, having to explain ourselves or instruct others, and observing how others react to our

behaviors. This type of learning, sometimes referred to as “social informal learning,” has been the subject of considerable research in learning organizations (e.g., Crans, Bude, Beusaert, & Segers, 2021) and is well-supported online.

An Example: Reddit

One of the most popular tools for online social informal learning is the Reddit system that combines peer support, question and answer, game motivation, access to more knowledgeable others, and recommendation tools – all with free (ad-supported) access. Although there are many thousands of subreddits (delineating topics of interest that can be subscribed and contributed to), among the most popular are the following:

- [r/LifeProTips](#) through which redditors share good ways of doing things, tips, or maxims
- [r/explainlikeim5](#), where experts give advice to beginners in simple words
- [r/ExplainLikeImPhD](#), where more detailed explanations are given
- [r/noStupidQuestions](#), where people can seek advice on any subject
- [r/changemyview](#) where people post contentious opinions and others argue against them

This is just a tiny fraction of the many learning-oriented uses of the site, many of which relate to highly specific skills and interests as well as those that are more general.

In a study of subreddits that they refer to as “learning in the wild,” Del Valle, Gruzd, Kumar, and Gilbert (2020) showed “that informal learning processes . . . are determined by the reciprocal and transitive nature of communicative ties among their members (p. 51).” They also found “that moderators play a key role in fostering interactions (p. 51).” Importantly, rules and norms emerge from members themselves as “new users are able to see and imitate observed practices (p. 53)” and “learning becomes an unregulated, incidental, and experiential process (p. 54).” The authors conclude that factors critical to success in these environments are “visibility, easy entry, lack of testing/examination, anonymity, access to gurus and notoriety—all available with minimal reference to gender, race, formal education, or social economic status.”

Other popular learning support tools of this nature include Quora, Slashdot, Discourse, and the StackExchange family of sites. Countless other independent forums support specialist interests, from owners of a particular brand of camera to stamp collectors. Some are huge. For example, the Amazon-owned Goodreads boasts millions of members, sharing and discussing books. Other more general purpose social media such as Facebook or Twitter serve many additional purposes that have also been shown to support “learning in the wild” (Kumar & Gruzd, 2019).

These sites are heavily used by students on formal courses as a means to complete work set by their instructors and, often, as a means to discuss other aspects of the course. Some may disrupt formal learning: there are subreddits dedicated to support for homework ([r/HomeworkHelp](#)) as well as ways of cheating on online proctored exams ([r/cheatonlineproctor](#)), for example.

Haythornthwaite et al. (2018) developed a coding schema that “contributes a content analysis schema for learning through social media, and an understanding of how knowledge, ideas, and resources are shared in open, online learning forums” (p. 219). This eight-point coding scheme extends and expands the popular COI model (Garrison, Anderson, & Archer, 2000) and coding scheme to this “informal” context. They add a potentially affective component (negative, positive, or neutral explanation, and positive or negative socializing) to the COI codes that documents the increased role of affect and commitment in informal learning – learners are not induced to remain, contribute, and learn by reason of paying a large tuition fee, fear of failure, desire for high grades, or other affective challenges associated with learning in formal education.

The Power of the Collective

Many of these systems benefit from recommender systems, filters, and other tools that aggregate, analyze, and produce views of digital information, from simple “thumbs-up” ratings to full-blown deep learning systems that delve into the content of messages and seek patterns to supply recommendations. What results is a cyborg entity that employs the aggregated behaviors of individuals in a crowd to shape their environment and to provide structure and influence in that environment that we have previously described as a collective (Dron & Anderson, 2009). Karma points (indicators of reputation, gained by having made what the crowd considers to be useful posts in a given area) and up-down ratings on Reddit, StackExchange, Quora, or SlashDot, for example, are used to provide ranking and emphasis for posts and their answers, resulting (in principle) in higher quality, more relevant posts being displayed more prominently.

Though seldom perfect, the algorithms and interfaces often succeed in providing useful recommendations despite vulnerability to gaming by those seeking attention and to the Matthew Effect (the rich get richer while the poor get poorer) that can result in inequitable power distribution among users. Collectives can thus play roles similar to that of a traditional teacher, guiding learners toward help that best suits their needs and interests. However, they are not always *good* teachers. In general-purpose social systems such as Facebook or Twitter, the intent of individuals may only rarely be to learn, and the algorithms may be more concerned with driving engagement or serving the needs of advertisers than with the support of learning. This can result in, among other things, active promotion of false, misleading, or biased content that may be counterproductive to learning. As Dron (2002) found, collectives only make good teachers when the communities on which they are based intend to learn and when the algorithms are not at odds with that intent.

Self-Teaching Resources

Teach-yourself books, manuals, and articles have long been a popular genre among intentional informal learners and remain so. However, to a large extent, they have

been replaced by online resources, many of which are free or ad-supported. Online informal learners may dip into hundreds of relevant articles, courses, videos, and even books, picking and choosing those that most closely match their needs, interests, skills, and tastes, providing support at unprecedented scale. Many of these mirror forms of teaching conventionally found in formal learning, including in many MOOCs that may bear almost all the trappings of traditional institutional teaching. However, without the coercion, formal enrollment, and accreditation frameworks of institutions, the ways in which they are used for learning may be anything but formal. Similarly, many governments, institutions, development agencies, and charitable foundations now support authors and multimedia companies to produce open educational resources (OERs) for formal learning that equally support informal learners.

An Example: Online Videos for Informal Learning

Few readers of this chapter will not have watched a video from YouTube, Vimeo, or another video repository to help them learn something. These videos offer tremendous opportunity at affordable cost to learn long sequences (e.g., a 20-part video series on learning to play the dulcimer) as well as short knowledge insights (e.g., how to clean a clogged drain) and ongoing routine activities (e.g., exercise classes). The 2021 Pew study of adult Americans found that 81% are YouTube users (Auxier & Anderson, 2021) of whom 86% found YouTube videos useful for informal learning (Smith, Toor, & Van Kessel, 2018).

In many ways, these videos substitute student-content interaction (watching the videos) for student-teacher interaction of the classroom. This substitution exponentially reduces cost through capacity to be used and re-used while increasing access through Internet distribution. In a 2017 study of 29,386 comments posted by viewers of 150 education-related videos, Lee, Osop, Goh, and Kelni (2017) concluded that YouTube can support a variety of learning and social affordances.

As Song and Bonk (2016) observe, informal learning must have a “fun” factor as the absence of external motivation may weaken desire to engage in hard work associated with learning challenging information or behaviors. Analyzing the behavior of thousands of participants in a MOOC, Breslow et al. (2013) found a high preference for video rather than text and images among learners. Though sometimes a more time-consuming way to learn simple tasks, videos are often more engaging than static text and images.

Rosenthal (2018) measured both students and community residents use and frequency of watching YouTube videos related to science topics – a type of “free choice science learning.” They concluded that the value of videos that enhance science knowledge of learners is conditioned by their general interest in science, the perceived value of science learning, as well as the entertainment value of the video. However, perhaps the most compelling evidence of YouTube efficacy for informal learning comes from reports from development agencies of rural villagers using the videos to repair water pumps and other equipment provided by donor agencies that, in the past, often sat idle for lack of expertise in repair and maintenance (Change for Children, 2021).

Supporting the Informal Learning Process

Self-directed learning has long been studied as a component of success in formal education. The converse is also true. We have decades of research on the efficacy of collaborative and cooperative learning in formal education (e.g., Johnson & Johnson, 2008; Slavin, 1996), for the use of experiential learning designs (Lewis & Williams, 1994), the value of a supervisor or mentor (Allen, Witt, & Wheelless, 2006), and other approaches that originated in classrooms. We also note the value of informal learning that arises within effective communities of practice (Viskovic, 2005). All such options are available online, through purpose-built collaboration/cooperation tools like Slack, Github, or email, as well as systems created to support ad-hoc transient learning networks of informal as well as formal learners (Sloep et al., 2007).

Supportive Physical Contexts

Contextual factors can greatly influence informal learning. For example, in a study of antecedents of informal learning among classroom teachers, Kyndt, Gijbels, Grosemans, and Donche (2016) found that just creating a space and supporting teachers gathering in a common staff room was perceived as critical for peer support, modelling, and problem solving. Similar support can occur online, through tools such as Microsoft Teams, Zoom, or Slack, or more personal instant messaging apps like Signal, Telegram, or iMessage.

Having time to learn is essential. Those whose time is curtailed by external factors including employment, family, and external social demands may have problems in maximizing their informal learning. Place-based learning usually takes time, not just spent learning, but on traveling to libraries, colleges, or other locations where it can occur. Online informal learners can learn wherever and whenever they need to learn, including through mobile phones or streaming audio while traveling.

Sharing and Reflecting

Effective learning involves more than just reading, watching, engaging, and doing. Yeo (2008) argues that informal workplace learning “is an inductive process of reflection and action, often linked to the learning of others and integrated into daily routines” (p. 318). Mature self-directed learners will often perform many of these roles themselves or seek others who can help, often through online collectives and communities to which they belong. Through engagement in social media and, for some kinds of learning, feedback inherent in the process itself can fulfill some of those roles. Finally, online informal learners benefit from managerial support and scaffolding, especially for reflection and sharing Ellinger (2005).

Moore and Klein (2020) reported that instructional designers tasked with supporting learning of all types within their organization found that sharing of information and resources was perceived as the most effective support for informal learning. One of the most effective ways to achieve such engagement is thus to share one’s learning in a public or semi-public online space, thereby not only reflecting on, demonstrating, and reinforcing the learning but also inviting feedback and support. This is one of the cornerstones of complexivist pedagogical approaches (► [Chap. 10](#),

“Pedagogical Paradigms in Open and Distance Education,” by Dron and Anderson, this volume). The Internet makes such sharing easy and benefits from scale. Rather than simply sharing what we learn with those close to us, we can share with anyone and everyone, and they can respond.

The archetypal tool for open sharing is the blog. Though often considered an elderly technology in an age dominated by huge social media platforms and proprietary organizational tool suites, blogs and similar tools still account for a majority of websites, albeit that most are in the long tail. Larger social platforms with public sharing defaults such as Twitter, Tumblr, YouTube, or TikTok and less open social networks like Pinterest and Facebook are also used to share the outputs and process of learning, often including links to blogs. While only a fraction of these are intentionally part of a learning process, the scale of the Internet means that millions of posts are made every day that, directly or indirectly, contributing to the informal learning of millions (Dron & Anderson, 2014).

Blogs and similar tools are also common in formal learning, especially when using complexivist-inspired pedagogies (Dron & Anderson, 2014). By mixing the formal and informal, students may make the formal more personal and more integrated with their broader learning journeys. The persistence of content on the web allows ideas and even formal courses to grow and evolve, year on year, through contributions from both enrolled students and interested informal learners, all teaching one another while they learn (Lockridge, Levine, & Funes, 2014).

Tracking Progress

Informal learning, whether intentional or not, is likely to be ineffective unless the learner monitors, analyzes, and reflects on the learning process. This includes not only measuring the productivity of learning tasks but also the monitoring of affective indicators such as boredom, impatience, tiredness, etc. Digital tools can support this. In a professional informal learning context, Littlejohn (2017) believed learning analytics could be used to find expertise, see current interest and level of activity and progress, and provide “a reflective mirror on their own learning activity relative and independent of self-set goals.” The key to all of these visualizations, comparisons, and monitoring efforts is that the result be fed back in useful formats and in a timely fashion to the learner.

Most learning analytics research and development has, so far, focused on its role as an instrument of student management in formal learning. As Klamma (2013) observed, there are many biases and pedagogical assumptions embedded in its use, notably including an objectivist focus on formal learning outcomes. There may, though, be value in capturing aspects of informal learning in the workplace through analysis of interactions on mobile and social systems, and even through analysis of video recordings, using social network analysis and AI tools that seek pedagogical patterns in interactions (ibid, De Laat & Schreurs, 2013). Beyond academia and some workplace settings, the surveillance that many learning analytics systems require may be deemed unacceptable, especially for incidental informal learning. However, tools that support the discovery of learning interactions within social networks and forums, identifying community goals, tasks, and connections, have

been used to good effect (e.g., Petrushyna, Klamma, & Kravcik, 2015), and work continues to automatically identify learning activities and interactions in open, online environments (e.g., Rizk & Rodriguez, 2021).

There are also plentiful tools to support the informal learner in more deliberately structuring and recording their learning. For example, bookmarking systems such as Pocket, Instapaper, or simpler tools built into web browsers can help learners collect, organize, and share resources of interest. Note-taking tools like Evernote, OneNote, Google Keep, or Joplin can serve not only as a repository of ideas, a learning journal, or a record keeping system but can also be used to collect and share and organize links, media, and digital artefacts. Such tools provide significant parts of what has become known as a personal learning environment (PLE). For some, the PLE is no more than a dashboard on a hosted service that brings together different tools and data within a formal system, often incorporating social media artefacts and interactions. For others, it may constitute the entire physical and virtual space that a learner inhabits.

Some researchers, such as Dabbagh and Kitsantas (2012), have explored the possibilities for PLEs to bring formal and informal learning together. They describe the value the PLE brings to the learner, as a means of integrating and accommodating what they learn in all settings. They also bring value to the teacher by making such learning visible and allowing teachers to accommodate and capitalize on knowledge of their students. Yen, Tu, Sujo-Montes, Harati, and Rodas (2019) provided compelling evidence that level of initiative, sense of control, and level of self-reflection are all highly supported by PLEs in both formal and (especially) informal learning. Analytics tools have also been used to help identify learning progress in PLEs (Klamma, 2013).

More recent initiatives, most notably in the conceptualization of the NGDLE (next-generation learning environment) have focused on a diversity of tools and systems that straddle the boundaries of formal and informal learning (Brown, Dehoney, & Millichap, 2015) and that celebrate a diversity of ways and means for learners to learn. While institutions may develop systems and tools for teaching, learners may provide and integrate their own and record lifelong learning journeys in learning record stores (LRSs) provided by institutions or, perhaps, through blockchain technologies that they own and control. This combination of PLE and institutional teaching systems results in shared ownership of the formal learning space.

Credentialing Informal Learning

Credentials for informal learning may be valuable for a few reasons. First, learners are often interested in demonstrating and being recognized for their informal learning accomplishments. Second, many formal education institutions are interested in assisting their learners and increasing market share by attracting learners with ways that their informal learning can be used to shorten and thus reduce the length and cost of their formal education. Finally, both employers and governments are interested in encouraging lifelong learning and finding ways to assess the relevance and veracity of this learning.

Though highly valued, “qualification outcomes [must] be relevant, understood, and trusted—and not just by learners, but by governments, institutions and employers” (Noonan, 2019, p. 8). Maintaining relevance is particularly challenging in contexts of rapid technological, political, and social change. Each of these stakeholders also have come to realize that traditional institutionally published credentials are soon dated, often arbitrary in terms of what and how credentials are awarded and are not scalable, transportable, accessible, or persistent.

A number of digital technologies have been developed to support both delivery and the credentialing of informal learning. These are dealt with at length in this volume including in ► [Chaps. 47, “Accreditation and Recognition of Prior Learning in Higher Education,”](#) by Conrad, ► [69, “Digital Credential Evolution,”](#) by West and Cheng.

Challenge Assessments

Assessment can be more completely decoupled from the learning process. The long history of challenge assessment stretches back to the University of London in the nineteenth Century, which offered examinations to students who had already acquired sufficient knowledge, whether through formal study, informal learning, or both, providing credentials for successful completion of the exam (Namie, 1989). Athabasca University and others continue this tradition to this day, offering a variety of ways in addition to summative exams to meet the challenge.

Storing and Sharing Credentials

When credentials for learning come from multiple sources, institutional and otherwise, it may be hard to keep a track of them, especially when they are micro-credentials, badges, and similar small-scale awards. A centralized system is one effective way to do this because it provides assurance of authenticity. However, over a learner’s lifetime, centralized systems are vulnerable to possible disappearance for many reasons, including attack, insolvency, and obsolescence. In addition, as noted by Bozkurt and Ucar (2020), providers of central systems often have vested interest in gatekeeping and maintaining control of transactions and value – controls that might favor or handicap learners, groups of learners, or certain institutions. Thus, the development of a variety of blockchain applications for both formal and informal learner accreditation are distributed across the network, so they are less vulnerable to attack or decay, their authenticity is less open to questioning, and they are owned by the learners themselves.

The use of blockchain expands the usefulness and functionality, visibility, immutability, and reliability for both microcredentials and e-portfolios and formal learning accreditation. However, despite the hype and support for blockchain use in education by some educational technologists, Bozkurt and Ucar (2020) noted a variety of concerns, many dealing with the inherent technological complexity but an equal number related to throughput, manageability, scale, adoption, and the variety of chains available. These are nascent technologies that may be even more short-lived than the centralized systems they replace.

Conclusion

Opportunities for and participation in informal learning have expanded exponentially with increase of access to and activity on digital networks – and they will continue to expand. We also can expect that formal learning systems will increase the use of informal learning resources and tools within their formal curriculum. This will create opportunities (and pressures) to develop new systems that take advantage of the accessibility, motivational benefits, and low costs associated with informal learning while retaining the structure and credentialing of formal learning.

Virtually, all learning has an informal element, insofar as what is learned is never static, is constantly reinterpreted and reintegrated after the intentional or unintentional acts that brought it about, and is always integrated by an individual with what they already know. Similarly, much informal learning relies upon at least some formal teaching, whether it be through the use of tutorials, MOOCs, teach-yourself books or websites, or simply watching a YouTube video intended to impart knowledge.

Formal teaching has weaknesses that informal learning can redress. Much formal teaching is low in value because learners have already (whether formally or informally) learned what is being taught. While reframing, rehearsing, and reflecting on existing knowledge can be valuable, it may bore students. Much formal teaching is also actively demotivating, due mainly to the locus of control not being the learner and consequent effects on the learning. Though learners may deliberately delegate control to others from time to time (such as when watching a video tutorial), informal learning is primarily controlled by the learner.

Good teachers already know about their students' informal as well as formal learning, giving freedom to explore areas of interest, utilizing rather than ignoring what students bring to the classroom. They learn what their students know and contextualize how and what they teach to meet their diverse needs, interests, and skills. There is therefore much to be said for helping students to develop skills of sharing their informal learning, through blogs and similar tools, in spaces that the students themselves own but that can be accessed by teachers and fellow learners, and/or through sharing via an institutional LRS. By integrating informal learning, rather than being a sage on the stage or a guide on the side, the teacher becomes a co-traveler, supporting rather than directing the learner's learning journey. This complexivist approach (► [Chap. 10, "Pedagogical Paradigms in Open and Distance Education,"](#) by Dron and Anderson, this volume) recognizes students as active teachers of one another, as individual agents with unique needs, and as people with lives outside the classroom.

Today's digital, networked infrastructure greatly expands the opportunities for informal learning. The means to value, assess, promote, and incorporate this learning into dominant social, commercial, and institutional structures provides both challenge and opportunity for learners, educators, and researchers.

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