

# Assessment, credentialling and recognition in the digital era: Recent developments in a fertile field

Sandra K Milligan, Gregor E Kennedy and David Israel

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## Introduction

The past decade has seen an unprecedented level of innovation in assessment, credentialling and recognition of learning, particularly in the burgeoning field of online learning in the post-school sector. These developments are of interest to those working in and around schools, from the following points of view.

- Schools and school systems have been intensely interested in using digital devices and applications in mainstream instruction, and in online and blended learning, but have made much slower progress than has been made in the more diverse, less regulated and more competitive post-school sector. Schools and school systems can use and/or learn from digital tools and techniques of assessment, record-keeping, analysis, and credentialling developed by both new and established post-school providers.
- Schooling has for several decades tried to shift the focus of assessment toward ‘outcomes’ and ‘competencies’, most recently in complex ‘21st century skills’ such as learning to learn or collaborative problem solving. Many post-school online providers have taken just this approach and have applied it successfully, at scale, to a wide range

of learning programs, using tools and techniques which may well be useful in schools.

- Some of these approaches are likely to be particularly helpful in reforming educational provision to better support the full range of students, encompassing the needs of all, from the most academically capable as well as ‘non-academic’ or ‘disengaged’ students. Micro-credentialling and badging have much to offer ‘alternative’ learning programs as well as programs which combine school and external vocational provision.
- One of the most innovative areas of post-school education and online learning is professional development. Teachers and others working in and around schools are big consumers of continuing education, and in some cases are providers as well.

In this paper we report conclusions from a survey, undertaken in 2016 on behalf of the University of Melbourne, of some of the most prominent and/or innovative developments in post-school online assessment and credentialling, focusing mostly on the continuing and professional development sector. The survey reviewed a series of case studies

**Table 1. Summary of case studies and snapshots, 2016**

<b>MIT MSCM Micromaster's</b> MOOC series used as a funnel into a residential master's degree
<b>University of Illinois iMBA</b> Wrapped MOOC as part of an imaginative iMBA
<b>Global Freshman Academy (Arizona SU and edX)</b> Low-cost digital freshman year
<b>Arizona State University Online (ASUO)</b> High-tech scalable online degrees for working people
<b>Wharton Business School (Penn State) Coursera Specialisations</b> MOOC specialisations used as talent spotter for MBAs
<b>The University Learning Store (ULS)</b> RPL-based path to non-accredited certificates for unqualified working adults
<b>Western Governors University (WGU)</b> Self-paced RPL-based-degrees for working adults
<b>DeakinDigital Master of Professional Practice (MPP)</b> RPL-based master's degree for practising professionals
<b>Georgia Institute of Tech. Master of Science in Computer Science (Georgia Tech MSCS)</b> Master's degree with Udacity for workforce preparation
<b>Modern States (edX, plus U Texas and 6 others)</b> Freshman year for second chance/working people
<b>Udacity nano-degrees</b> Nano-degrees for building specialist expertise for professionals
<b>Kadenze MOOC platform</b> MOOC as for-credit funnel to design and arts courses
<b>Miscellaneous snapshots of universities using Mozilla Open Badges Infrastructure</b> Deakin, Derby, Bradman, Michigan, Purdue, Penn State, Open University UK, Illinois
<b>Tools for scaled digital assessment</b> <a href="https://openedx.atlassian.net/wiki/display/COMM/XBlocks+Directory">openedx.atlassian.net/wiki/display/COMM/XBlocks+Directory</a>
<b>Snapshots of international institutional credit alliances</b> PluS 'Skyteam', OpenUpEd,
<b>Snapshots of initiatives on integration of MOOCs for credit</b> Deakin, Tasmania, Oxford Bridge, Edge Hill, Penn State, RMIT, QUT, The ECO Project
<b>Snapshots of recognition by non-accredited providers</b> Big-data University (IBM) Kiron University for Refugees; nopayMBA.com community

(Note: MOOC is the acronym for Massive Open Online Course; RPL: recognition of prior learning)

and 'snapshots', summarised in Table 1 and accessible in full at [www.arc-ots.com/arc/CompanionDocument.pdf](http://www.arc-ots.com/arc/CompanionDocument.pdf).

The survey sought answers to questions such as:

- How are digital innovations able to support meaningful reform, which makes educational institutions 'smarter' and more able to improve learning for all?
- How is it possible to ensure quality and credibility in digital teaching?

- How can assessment and certification practices in digital learning environments be made trustworthy?
- Can credit for these studies be integrated and recognised within established online and face-to-face programs?
- What strategies can be used to engender trust in the quality of provision?

The case studies and snapshots were compiled from media coverage and publically available strategy papers and materials. Included was a range of higher education providers, mainly universities,

some of which are high profile, and non-accredited providers. The case studies were not represented as being indicative of ‘winning strategies’ in this rapidly changing field. The objective was to provide an information base, and to identify emergent themes in warranting quality of learning outcomes in digital courses by focusing on practices in assessment, credentialling, and recognition. Some initiatives were barely a few months old when described; none was more than 10 years old. Some emerged from long-standing institutional strategies in distance learning and/or technological innovation (as with Arizona State University or DeakinDigital). There is little reliable evaluation or review of the initiatives canvassed.

The survey highlighted the diversity in strategies that institutions used to incorporate digital offerings into their programs. The impression gained was that the case study institutions were still considering what **can** be taught, **how** it is best taught and assessed, and what **cannot** be taught in digital courses. Community attitudes to internet-based delivery of educational services are still evolving, and are responding to factors such as increasing costs to the consumer of traditional teaching services, increasing requirements by industry and professions for continuing professional development (CPD), the proliferation of options and providers, and the deployment for educational purposes of emergent social media, machine learning, intelligent learning analytics, and cognitive computing. If anything, the case studies suggest **experimentation** as a common approach – mixing, matching and continually revising approaches to assessment, certification, and quality assurance to match the specific circumstances and business cases of any course. Re-visits to the web sites of these case studies, even within a period of six months, often revealed evolution in rhetoric, approach, and practice.

## Emergent themes

During the survey, it was possible to identify 10 key emergent themes relating to quality, especially as expressed in approaches to assessment, certification and recognition. A summary of these key themes is provided in this paper.

### Theme 1: Broadening scope of learning outcomes being warranted

Significant numbers of cases suggest that providers are responsive to employers, industry, and professions, in defining the scope of what can be learned and credentialled in their courses. They reveal effort to expand the warrant for learning to encompass outcomes other than those conventionally emphasised in education – mastery of knowledge and integrated understanding within a domain (Biggs and Collis, 1982). Three overlapping threads are evident in this expansion of scope.

The first is that attention is given to attainment by students of **generic** or **soft** skills or competencies, often referred to as ‘21st century skills’, as represented in the 2015 World Economic Forum graphic reproduced in Figure 1. The development of such skills is often claimed by education institutions at all levels of learning,<sup>1</sup> but is rarely assessed (Martin, 2016), and the quality of learning outcomes in these areas is not well guaranteed.

The second thread relates to the development of specific competencies in areas of practical expertise or professional skill. Development of professional skill has long been fundamental to professional degree courses, but such skills are rarely expressed, taught, or assessed as competencies. Further, competence of the kind targeted by continuing and professional education is often specific, complex, developmental, impermanent, and context-dependent. Many case study

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institutions position themselves as being particularly responsive to the requirements of employers seeking to improve productivity; of professional associations seeking to warrant the continuously developing skill of their members; and of job seekers wanting to demonstrate attitudes and know-how relevant to the workplace.

A third extension of competence warranted in a small number of cases is the development of metacognitive skills or learning skills to equip individuals for career-long learning. Often emphasised are individuals' understanding of principles of learning, as well as intellectual tools and learning strategies needed by self-sustaining, life-long learners (Bransford et al, 2003).

The increasing importance of expanding the scope of learning through CPD was recently summarised by the chief executive

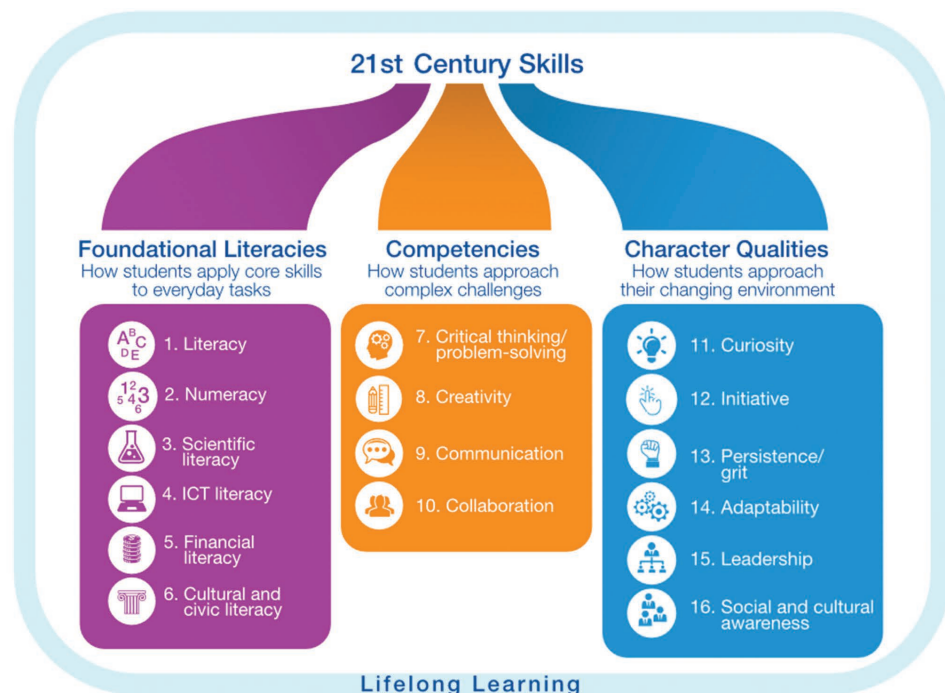
of the Australian Chamber of Commerce and Industry (ACCI):

*[A] number of our members are consistently telling us they're seeing students come out of university or training programs and they might have the academic or theoretical skills but no skill to work at all. It makes them really hard to employ.*

(Burke, 2016)

Not all the case studies reference such competencies in their learning outcomes – GFA, for example, and Modern States, appear to adopt a standard academically-oriented curriculum – but these are exceptions. A commitment to ensuring that the learning outcomes and assessments cover one or more of these additional areas of learning is evident in most of the case studies. The UK's Open University now provides micro-credentials (badges) for attainment of learning skills.

**Figure 1. Sixteen 21st century skills required for lifelong learning**



Source: World Economic Forum, 2015, p 3.



WGU, the University Learning Store (ULS), the Wharton Specialisations on Business Foundations, Udacity, and Deakin and the IU iMBA all argue that their approach to assessment and credentialling provides assurance of generic and specific employability skills of value to employers and/or the professions. WGU claims that its students outperform others in professional registration examinations as a result.

Hand in hand with an expanded scope of learning outcomes is the expression of these outcomes at a much more granular level than would be recorded on, say, a degree transcript. Expected learning outcomes are stated as specific competencies, and the statements describe in some detail what learners are expected to learn, what they will be able to do and to what standard. Specific competencies often form the basis for both formative and summative assessments, as in the cases of Georgia Tech and DeakinDigital.

Thus, a consistent theme in the case studies is that the value of credentials provided depends in part on the claim that the teaching and assessment targets specify learning outcomes, not only in base knowledge and understanding, but also in (a) generic graduate outcomes in the 'soft areas'; and/or (b) specific professional skills; and/or (c) metacognitive learning skills.

## Theme 2: The micro-credential ecosystem

The certification practices of almost all of the case study institutions feature the use of micro-credentials. 'Micro-credentials' is the generic term for a range of credentials for units of learning smaller than those covered in degrees and school certificates, and includes 'nano-degrees', 'micro-master credentials', 'certificates', and 'badges'. In other contexts they might also include 'ratings' or 'licences' or 'endorsements', or 'memberships'.

Digital micro-credentials represent more than just recognition of smaller packets of learning. They are components of a digital ecosystem for warranting learning. Badges are the most recognised and functional form of micro-credential, and are examined below to illustrate what is meant by a 'digital ecosystem of micro-credentials'.

The term 'badge' refers to the simple digital graphical file used to represent the credential. A 'badge ecosystem' comprises the following (drawn from Acclaim, 2013; Educause, 2014; Oliver, 2016).

- *Badge issuer.* An education provider or an employer who creates a badge and defines competencies to be developed by a candidate with sufficient granularity to predict future performance in particular skills. The issuer sets standards for attainment of the competencies; assesses candidate performance; and provides an interpretation of what the individual has learned or can do.
- *Badge earner.* The individual who earns the badge, usually identified by an email address. The earner must meet the standards set by the issuer, and provide the evidentiary base that the issuer uses to assess the level of attainment.
- *Badge graphic.* A graphical image in .png format that summarises key information about the badge, such as the topic and the issuer.
- *Badge metadata.* Information provided by the issuer, such as the criteria, standards, and assessment required for credentialling; expiry dates; where and when the badge was earned; and the identity of the assessor. The scope and format for metadata is increasingly standardised.

Digital micro-credentials represent more than just recognition of smaller packets of learning. They are components of a digital ecosystem for warranting learning.

at this stage at least, micro-credentials have relatively limited recognition or currency

- *Linked evidence.* Digital information supplied by an earner to amplify or illustrate attainments, which may include portfolios, videos, essays, and so on, and is usually available through a user's 'backpack' containing the badges and links to the evidentiary base.
- *Badge provider.* An organisation such as Mozilla, Credly, or Acclaim which provides technology infrastructure, templates, and professional support to an issuer.
- *Badge displayers.* Organisations such as LinkedIn, Twitter, Facebook, and employment sites, which enable an earner to publicise and disseminate their badges to stakeholder groups.
- *Consumers/stakeholders.* Individuals or organisations such as employers or professional or industry associations to whom badge earners wish to demonstrate their competence.
- *Endorsers.* Individuals or organisations, such as an industry group, professional association, or employer, who endorse or recognise the badge.

In summary, a badge is devised with a particular category of learner and consumer in mind. Issuers articulate appropriate outcomes and standards, collect evidence from each candidate, and assess capability and verify the identity and the contribution of the learner. The issuer creates standardised digital metadata, explaining in detail what individual credential holders have learned and what they can do; how their attainment was assessed and by whom; and what quality assurance was associated with the assessment. The issuer and earner can use badging to promote themselves through social media.

Micro-credentialling in CPD is integral to the strategy of most of the institutions

covered in the case studies. They include nano-degrees (Udacity); a micro-master's credential (MIT); the recognition of MOOC certificates for various purposes; and formal certification of components of CPD offerings (DeakinDigital, ULS, Modern States, Big Data University). Badging is used as a form of motivation, and/or to provide specific information about specific competencies within a larger qualification (Mozilla OBI, Michigan and Purdue).

Institutions including Illinois, Deakin, Udacity, the ULS and the Big Data University regard their embrace of digital micro-credentialling as a key competitive advantage. They expect that micro-credentials, allied with digital social media tools and endorsements of micro-credentials by stakeholders, will build trust in the quality of their products, help market graduates, and build a global profile for their programs (Weise and Christensen, 2014).

Micro-credentialling (badging) also has its critics. While there is a range of resources to support education providers wishing to use badges,<sup>2</sup> experience to date suggests that badging and other forms of micro-credentialling are not simple (Freund and Rutherford, 2014). Obstacles include cost, time, complexity of the policy and legal environment, privacy issues, ownership of the badge or micro-credential, verification and integrity issues, student concerns about credibility, faculty acceptance, and students' attachment to conventional, paper-based processes. Other problems are that, at this stage at least, micro-credentials have relatively limited recognition or currency, and that the systematisation and structuring of informal learning by micro-credentials risks devaluing the emergent, unstructured learning in employment-related learning (Jenkins,

2012). Critics also argue that micro-credentialling will further marginalise the non-credentialled; that other models and approaches can achieve the same ends; and that gamification of micro-credentials will undermine intrinsic motivation for learning. It is further argued that micro-credentialling could fragment programs of study and atomise learning, thus running contrary to contemporary understandings of learning as a developmental, accretive process, often slow and erratic, and demanding effort and interaction with peers and mentors.

The digital ecosystem nevertheless provides the institutions in the case studies with the means to create credentials with a great deal of information about the specific capabilities of individuals that are of interest to consumers, and that can be reported and reviewed in a digital form, allowing a consumer to evaluate and rate them. It allows stakeholders to audit exactly what a credential holder has learned and can do. Earners can supply further supporting evidence of their capacities in digital portfolios, visible to a consumer. Because micro credentials are very specific, they are particularly useful in providing the evidentiary base for specific graduate attributes in 21st century or soft skills, or specific aspects of specialist professional skill, or even metacognitive skills. They make possible the warranting of performance to a level not hitherto possible.

### **Theme 3: Adding value to micro-credentials with pathways**

One response in the case studies to the charge that micro-credentials might fragment learning is to aggregate micro-credentials. In the terminology of the movement, micro-credentials are

‘stackable’. They can be joined together to form other larger credentials. Coursera specialisations and edX x-series are examples of stacking.

Stacks can be quite elaborate. For instance, MIT MSCM supports a candidate to earn an edX certificate for each of the MOOCs they study. Clusters of three or four of these ‘stack’ to form edX x-series certificates, which in turn are combined with a proctored examination to satisfy requirements for the MIT micro-master’s credential. Finally, a residential component is stacked on the micro-master’s credential to satisfy the award of a master’s degree. Each of these individual certificates has value for participants, but together they constitute an integrated program of study that leads to a master’s degree.

Other institutions are using MOOC micro-credentials as an alternative means of qualifying students for entry. For example, the MIT uses MOOC certificates as alternatives to the GMAT; it argues that the MOOC-based micro-master’s credential provides ‘significant insight’ into candidates, and confidence about standards of attainment of candidates accepted into the program.

### **Theme 4: Adding value to micro-credential through enhancing recognition**

Many of the case studies report efforts by providers to generate recognition for micro-credentials that goes beyond their value in their own institutions. They are seeking to make their micro-credentials ‘portable’ – that is, more widely recognised for uses including stacking within more than one credential.

MOOC certificates, and other informal and unaccredited credentials, already enjoy some recognition for CPD points by

Many of the case studies report efforts by providers to generate recognition for micro-credentials that goes beyond their value in their own institutions. They are seeking to make their micro-credentials ‘portable’

Research into the current state of educational leadership indicates that many systems are struggling with a shortage of school leaders, but also that current leaders have room to develop as more effective leaders of learning.

professional organisations. For instance, Melbourne University's ATC21S MOOC certificate is recognised for teacher CPD by the Victorian Institute of Teachers, and by a number of US state authorities through a program organised by Coursera to attract federal government reimbursement of MOOC participant costs for CPD programs for US teachers. A number of European institutions develop their MOOC credentials to match European Transfer and Accumulation System (ETSC) criteria for transferability within the EU.

Another means of adding value through portability is the negotiation of credit agreements between education providers. Kiron University, established for the specific purpose of providing education to refugees, has negotiated arrangements for its MOOC-based micro-credentials to count for credit in a wide range of institutions. The Modern States Freshman Year provides credit in its member organisations for students holding MOOC certificates from a range of institutions, based on an independent credit-by-exam option organised by the American Council of Education (ACE). The planned alliance between Delft, UNSW, Kings College London, and the ANU, provides another example of how value can be added to micro-credentialling.

A number of the case studies also highlight efforts by institutions to build partnerships with employers, in pursuit of 'recognition networks' for specific micro-credentials. Examples include the partnerships of Georgia Tech with AT&T, of Wharton with a range of major organisations associated with its MOOC specialisations, and ASUO's relationship with Starbucks. So confident is Udacity in the recognition of its nano-degrees in the industry that it provides credential-holders with a money-

back guarantee of employment within six months of graduation.

These efforts are being made in the context of reports (Bryant, 2013; Birch, 2014) that a range of global employers have dispensed with degrees as prerequisites for employment; that they do not find degree transcripts particularly useful; and that they do not find university records to be good predictors of employment success. The proportion of individuals with no college education employed by Google (a reported 14 per cent of some work teams) has increased. Ernst and Young, PriceWaterhouseCoopers, and the publisher Penguin Random House have decided to drop the degree as a requirement for job applications. Some human resource management professionals argue that micro-credential records of prospective employees (which are accessible openly or by invitation on the Internet, documenting knowledge and competencies) provide more effective selection tools than traditional credentials. DeakinDigital has engaged Hudson, an international recruiting firm, as its 'assessment partner', suggesting a view that micro-credentials will form an important part of the data environment within which employers now operate.

Formal regulation of micro-credentials by recognition agencies has also been under discussion for some time. For instance, in 2012, the Gates Foundation sponsored an Alternative Credit Project (ACE) which reviewed a pool of low-cost and no-cost online courses, including MOOCs, and negotiated credit arrangements with a number of middle-to-lower tier higher education institutions. The ACE web site indicates (June 2016) that only three EdX MOOCs (from Boston University) were accepted by ACE's 2015 credit



recommendation process, and credit is available for those MOOCs from 20 institutions. It was reported by Jeffrey Young in April 2015 that since 2013, when the scheme began, no more than 50 students had requested that a MOOC transcript be sent to a college, and there is no data on how many of those colleges have accepted the credit. The European Transfer and Accumulation System (ECTS) and the European Credit System for Vocational Education and Training (ECVET), which began life as credit transfer agencies for formal degree and VET courses in Europe, are now broadening their remit on credit transfer as a means of **promoting** the portability of micro-credentials in the interests of individually customised learning paths, a shift in rationale driven by convenience for mobile students.

Newer kinds of credential frameworks and agencies are being developed to support the utility of micro-credentials. For instance, the Lumina Foundation has made a proposal for a credential registry and taxonomical framework (Everhart et al, 2016) and the IMS Global Consortium Digital Credentialing initiative<sup>3</sup> is aiming to develop standards for metadata to support analytics, interoperability, and definition of badges. Many professional associations are moving to provide cloud-based apps supporting management of micro-credential portfolios as part of member services. Examples include *MyPD*, supported by the Victorian Institute of Teaching (VIT) for use in teacher development, and applications provided by the medical profession's colleges to support continuing medical education.

IBM's Big Data University, and plans mooted by corporations including Apple and Pearson to become higher education providers, suggest that effective recognition

may no longer be the prerogative of education regulation. Credentials provided by reputable industry players are valued by students, especially when those credentials are targeted to skills – such as presentation skills and capacity to work in groups – that employers say they are seeking.

In sum, the case studies illustrate initiatives and plans by a significant number of institutions to establish, as part of the warrant for their micro-credentials, that these micro-credentials are not only informative, easily communicated, evidenced attestations to specific competences valued by specific employers, but are also stackable and portable, and thus capable of wider recognition.

### **Theme 5:** **Competency-based, developmental assessment**

Although the term is not used, a 'developmental approach' to assessment is evident in many of the case studies. Developmental assessment approaches (Masters, 2013) are not new, and are often regarded as an outgrowth of professional and vocational education. A developmental approach underpins forms of assessment which both develop learners and attest to their competencies. Core to the developmental approach is articulation of progressions of competence – standards against which a learner's progress can be measured. Professional standards,<sup>4</sup> used in the health<sup>5</sup> and teaching professions<sup>6</sup> provide examples of such progressions, but they also underpin many other CPD requirements for professional registration or licensing. These professional standards typically describe the full scope of attributes required, including generic skills, values, beliefs, and professional or occupational skills, as well as domain knowledge and understanding.

Many professional associations are moving to provide cloud-based apps supporting management of micro-credential portfolios as part of member services. Examples include *MyPD*, supported by the Victorian Institute of Teaching (VIT) for use in teacher development

Developmental assessment places demands on learning designers.

However, it is not easy to assess levels of individual attainment against such standards. Assessment typically involves the accumulation of a number of pieces of evidence. Assessment tasks must be 'authentic' – that is, they reflect real-life practice. They may include exams and tests, ratings of portfolios, peer-and self-assessments, 360-degree assessments, assessments generated through games or simulations, automated intelligent assessments, and/or expert reviews. Peer and self-evaluation as evidenced in studio-based or clinically based teaching has an important role in developmental assessment for continuing and professional education. Being able to assess, evaluate and provide feedback to peers is an important metacognitive skill. Complex performances assessed by expert teaching staff and/or by employers may require the assessed individual to be in a workplace or internship, clerkship, or similar setting.

Developmental assessment approaches contrast with summative grades based on a small number of assessment tasks (term assignments, tests, exams, and essays) in time-limited classes. A developmental approach takes the argument for quality away from the character or method of grading of a particular high-stakes assessment. Rather, it depends on establishing for any credential an evidentiary system that supports an on-balance judgement of the extent to which an individual has attained the competencies specified, to the standards required.

Developmental assessment places demands on learning designers. It demands the design of the learning outcomes in terms of progressions; the design and management of authentic assessment tasks at each stage of competence; allowance for multiple attempts on assessments; and

integration of a range of different kinds of scaled evidence to support an on-balance judgement of competence. Further, peer and self-assessment is often resisted by students (Boud et al, 2001) and is difficult for teachers to organise. However, digital environments can and increasingly do provide the scale and the tools to support design and implementation of developmental assessment approaches and credentialing using them.

The seeds of developmental assessment approaches can be seen in many of the case studies of assessment practices. For example, ASU Online use its partnerships with Knewton and Pearson to stress adoption of continuous formative assessment against concept maps. The Learning Store and the DeakinDigital MPP express learning outcomes in terms of developmental continua or maps of competence to which assessments and certification are tied (and, in the case of Deakin Digital, they are also tied to the AQF). Udacity, DeakinDigital, and Wharton specialisations emphasise the building of digital portfolios which evidence complex learning attainments. Udacity, Wharton, Illinois, and Arizona Online use close industry collaboration to develop authentic assessments, and to mark student performances to standards agreed by the industry partner. The Kadenze MOOC platform has been created specifically for students of the fine arts and graphic design, and all assessments support portfolio development. Udacity makes a feature of using authentic assessment tasks devised by its industry partners as the basis of a portfolio for each student.

Relatively few of the institutions described (DeakinDigital, the Learning Store, and ASUO) reveal a commitment to fully-fledged developmental assessment. However,

in many of the cases, providers claim a developmental approach as an advantage for their students, a claim based on their use of industry-recognised standards-based progressions to anchor their credential standards. The integration of assessments of different types has been used to argue that credentials reflect expertise relevant to profession or employer. A developmental approach has been sold by organisations including Udacity, UI iMBA, Georgia Tech, and Kadenze as offering assessments which generate for students artefacts for subsequent use in searching for jobs, applying for promotion, acceptance into for-credit courses, or garnering support from sponsors or investors.

### Theme 6: Recognition of prior learning

Recognition of prior learning, or RPL (also known as assessment of prior learning, or assessment of current competencies, or recognition of current competence) has long been a feature, in some forms, in higher education. Even the most selective institutions provide opportunities, on a case-by-case basis, for a candidate to gain credit for a unit or part of a course for which they have credentialled evidence from a comparable institution.

In the context of CPD, however, RPL strategies are being given greater prominence, relying not just on previously credentialled learning, but on previous life and work experience, on providing not just credit for part of a degree but for an entire credential, and as a routine service provided to large numbers rather than on a case-by-case basis.

The ULS, the WGU, and DeakinDigital's MPP case studies illustrate this substantial expansion in the scope and nature of RPL.

Teaching is not the starting point; it is provided only as and where it is required by individual learners. DeakinDigital encourages candidates for its MPP to develop personal learning plans to address any perceived gaps in competence, in which candidates can use Deakin's digital teaching resources or other resources to which they might have access in their workplace or elsewhere. The ULS awards certificates on the basis of RPL, and charges for optional tuition. WGU supplies teaching services on a subscription basis – on a timed, pay-for-what-you-use basis, an attractive option for students who have experience and/or are in a position to tap teaching support elsewhere.

Other applications of RPL are also evident. In the cases studied, RPL is the most common approach to converting informal course certificates (such as those deriving from MOOCs) into credit in degrees (OECD, 2010). The MIT MSCM, the UI iMBA, and the Global Freshman Academy accept MOOC certificates, even those from their own institutions, on the basis of an RPL approach, usually supported by extra assessment for candidates who have completed requirements of the MOOC, thus avoiding the lengthy processes that would be required for the accreditation of a MOOC. A financial disadvantage for US students is that RPL fees are not reimbursed through student financial support programs.

The external environment of the learners has been used as a source of learning for credit, and in some cases **only** workplace or extra-curricular experience is accepted. For instance Michigan University badges competencies attained through their co-curricula program.

The integration of assessments of different types has been used to argue that credentials reflect expertise relevant to profession or employer.

The institutions concerned have not regarded teaching as the only acceptable starting point for the acquisition of a credential. In this view, teaching is an option, provided only to the extent required by each learner, an approach particularly suited to learners already in the work force

MOOCs have played another role in RPL. Programs run for the US Department of Defense have provided a credit-by-exam option, with exams conducted at more than 1200 centres both within and outside the US (including in Perth and Canberra). The program has been supported by the accreditation processes of the ACE, and its assessments are accepted for credit by more than 1900 colleges and universities. No teaching is provided, but MOOCs and other similar courses are promoted as excellent preparation for these exams.<sup>7</sup> For example, an exam-for-credit on the science and analysis of organisational behavior is linked to Stanford University's MOOC on Organizational Analysis. UM's Macroeconomics MOOC is recommended as preparation for a related exam in the College Level Examination Program (CLEP).

Such uses of RPL weaken or break the nexus between teaching (on the one hand) and assessment and credentialling (on the other). The institutions concerned have not regarded teaching as the only acceptable starting point for the acquisition of a credential. In this view, teaching is an option, provided only to the extent required by each learner, an approach particularly suited to learners already in the work force, and foreshadowed in the early days of MOOCs (Ernst and Young, 2012). It may also reflect the reality that advanced professional and industry knowledge and know-how is increasingly distributed across organisations, and countries. In response, the case study institutions have found ways to build a warrant for their services on credibility as assessors of the competence, rather than or as well as selectors of candidates for admission and/or as teachers.

## Theme 7: Validation of assessment standards

The warrant for many of the innovations discussed above depends on the validity of assessment and the claim that assessment practices provide a full and accurate account of what those credentialled have learned and can do, and to what standard.

The case studies report a wide range of approaches to ensuring assessment validity.

- Georgia Tech has moderated outcomes for its MSCS digital learning by requiring learners to respond to the same assignments as on-campus students; assessors are blind to the student's stream.
- Some institutions (MIT MSCM, Penn State, Georgia Tech, and WGU) have relied on traditional examinations: candidates have been required to sit a timed, proctored examination, graded by expert markers, an approach which permits moderation of assessments, but not 'authentic' assessment.
- Kadenze MOOCs have used the seat time to credential learners, an approach which mirrors its time-based subscription pricing, but does not reflect its commitment to authenticity in assessments.
- The Wharton business school and MIT have allowed candidates with the requisite MOOC micro-credentials to go through a modified selection process for entry into the post-MOOC phase. The application fee has been waived, as has the requirement to sit GMAT. However, there has been a rigorous selection process, not necessarily consistent with the claims by these institutions to be broadening access and democratising education.



- Udacity has required project outputs that profile an individual's capability, using industry-designed projects with expert reviewers.
- Deakin has offered the most comprehensive of the systems examined: commitment to developmental assessment; using industry-approved rubrics to guide assessment against agreed standards; micro-credentialling for each element; and the requirement that candidates provide an extensive evidentiary base by means of portfolios and capstone assignments negotiated with employers (Cisco in the case of the MPP(IT)) and assessed by Deakin staff.
- ASU Online has claimed a similar approach, using assessments from its Knewton and Pearson partnerships, tied to concept mapping.

These approaches are not, in the main, comprehensive, and some demonstrate inconsistency with the breadth of the curriculum goals articulated as the objectives of the CPD programs of the provider (for instance by using proctored written examinations when practical competence is the objective). It seems likely that many institutions have yet to determine how they might validate their assessment regimes to match their claims and aspirations.

## Theme 8: Ensuring academic integrity

There are risks to academic integrity in the digital environment, as in any other. These include plagiarising or fraudulently passing off work (including contracted work) as one's own. Exams or tests can be hacked. Candidates can use inadmissible materials including prepared notes, and engage in collusion or inappropriate collaboration. Bibliographies, interviews,

and other artefacts can be fabricated or falsified.

It has been claimed that cheating in the professional and continuing sector is chronic, widespread, and increasing, and that it is more severe in digital than in conventional assessment environments. One study (McCabe et al, 2006) found that 56 per cent of MBA students, 54 per cent of graduate students in engineering, 48 per cent of graduate students in education, and 45 per cent of graduate students in law admitted to cheating. Another (Roberts and Wasieleski, 2012) found that the more online tools college students were allowed to use to complete an assignment, the more likely they were to copy the work of others. One authority<sup>8</sup> reports that over the 20 years he has studied professional and academic integrity, 'the ethical muscles have atrophied', in part because of a culture that exalts success, however attained – the attitude, he says, is 'we want to be famous and successful, we think our colleagues are cutting corners, we'll be damned if we'll lose out to them, and some day, when we've made it, we'll be role models. But until then, give us a pass'.

In the digital environment it is harder for staff to detect cheating among students they do not know. If, as some argue, the best way to combat cheating is to develop a culture of integrity and responsibility – difficult enough to do in a sustained way among on-campus undergraduate students – the difficulties may be insurmountable in short courses where the provider is just one among a number of influences on attitudes.

The cases studies illustrate a diversity of approaches to this issue.

- *Creating a climate of integrity.* Coursera, for example, has asked participants to make a declaration each time they submit an assessment.

In the digital environment it is harder for staff to detect cheating among students they do not know.

- *Human proctoring.* Organisations such as MIT have used services which require students to attend proctoring centres to sit examinations, as do organisations such as ACE for CLEP. Human proctoring is often organisationally and logistically difficult, and is expensive, with costs many multiples of the cost of using remote proctoring .
- *Remote proctoring.* A range of firms<sup>9</sup> has provided anti-cheating products and services suitable for some digital assessments. In the most rigorous forms of digital on-demand proctoring (as used by GFA, for example) students agree to do an examination alone in a room while a camera watches, a microphone listens, and their machines are locked down. The students are observed remotely by proctors. If they or sensors detect anything out of the ordinary, the anomalous behaviour is flagged in the recording and reviewed. If the review determines suspect behaviour, the reviewers refer the case to the educational institution for follow-up. This system is convenient for the examinee, affordable and scalable. One disadvantage is the difficulty in following up, and adjudicating, suspicious events. There is also some doubt about remote proctoring's capacity to pick-up well-hidden efforts at cheating.
- *Analytics-based identity verification.* MOOC provider Coursera has used keystroke pattern recognition software provided by Pearson to verify an examinee's identity (or at least to verify that they are the same person who logged on previously). Such 'intelligent systems' are being developed apace. MU, for instance, is sponsoring a project to use natural language processing to identify writing signatures to confirm

the identity of a writer during a writing exercise.

- *Plagiarism detection software.* Software such as Turnitin and PlagiarismDetectViper are commonly used.

Expert opinion is that the use of remote (and even human) proctoring, and other technological solutions, is more likely to result in an 'integrity arms race' than to solve the problem. As reported by Dawson (2016), it is possible to circumvent security features provided by software. Any assessment conducted on student-owned hardware is in theory vulnerable to circumvention or hacking.

There are also deeper concerns. The type of assessments supported by these means – typically timed examinations or structured activities conducted online – are weak forms of assessment. Further, a recent study (Simon, 2015) suggested that difficulties related to academic integrity go much deeper than merely detecting and stamping them out. Instructional practices and policies that might be appropriate to text-based work (essays or theses) might be inappropriate for other contexts. An 'unbreachable rift' has been found between the goal of authentic assessment, which often entails unsupervised, collaborative, iterative work, and the need for summative assessment of individual effort. Further, there has been divergence of opinion among teachers about what student practices are perceived to be acceptable and those that are considered to be plagiarism or collusion. Students who share code, for instance, or who jointly explore the same themes in a work, have been regarded by some teachers as cheating, while others regard them as capable collaborators. Re-use of material for different purposes has been considered self-plagiarism in some

contexts, but as an objective for people working in open collaborative contexts and as just plain common sense for practising professionals. A firm base for determining where lines should be drawn does not always exist, especially in CPD.

The best protections against cheating have been found to be perception of what peers do: if people think others do not do it, they tend not to. Another key factor is the likelihood of being reported. Cheating is more likely if grading is competitive and less likely if standards-based. It is possible to design open assessment tasks where some forms of cheating (such as looking up reference materials) are irrelevant. Severe penalties act as deterrents, as does a perception that staff are committed to integrity and that assessments are fair.

Few of the case studies summarised earlier provide evidence to suggest that they are acting upon an informed understanding of the nature of academic integrity for CPD, and what this might suggest for digital provision.

### **Theme 9: Digital tools for supporting assessment, credentialling, and recognition**

Scepticism about automated or digitally-enhanced assessment is widespread, perhaps fuelled by the widespread inappropriate use of multiple-choice exams, and direct tutoring systems.<sup>10</sup> However, teaching and assessment in a digital environment has sparked development of a new generation of high-tech tools for assessment and credential management. Development began in the 1980s with the advent of computers in education, but has subsequently accelerated, stimulated by rapid developments in cognitive computing, assessment and measurement science, machine learning, and learning

analytics (Scardamalia et al, 2013). The case studies suggest a common view that learning can be enhanced substantially by careful deployment of digital tools supporting developmental assessment, learner feedback, enhanced validity, credential management and integrity management. Practices cited include the following.

- *Portfolios.* Udacity, DeakinDigital, ULS, Illinois, and Wharton have used digital portfolio technologies in their warrant for authenticity of assessment. Learners can demonstrate complex competencies through display of digital evidence. Such evidence may include products as diverse as business plans, programming or test products, videos of people teaching or consulting with patients, and fashion or design portfolios.
- *Peer assessment.* Emergent technologies to support peer and self-assessments (Staubitz et al, 2016) have become common.
- *Automated assessment.* Sophisticated automated tools, as evidenced in the x-box assessment available in edX MOOCs, are available for a range of assessment purposes, including testing knowledge and understanding in any field, and assessing skill in programming, computation and problem solving. Automated assessments have also been used in the context of simulations (virtual reality environments) including virtual patients or legal clients, and haptic devices. Automated assessments are free of many of the limitations of human assessors – they can be more objective and reliable, provide more and richer feedback, at any time of day or night, do not suffer from rater bias, standards drift, or halo effects, and they never tire.

The best protections against cheating have been found to be perception of what peers do: if people think others do not do it, they tend not to.

The case studies are littered with descriptions of new generation tools embedded in the platforms

- *Intelligent essay marking and natural language processing.* These applications have been used routinely in edX MOOCs. They cannot yet assess qualities of text, such as humour, but will almost certainly become more capable. The Georgia Tech MSCS recently used a chatbot (built using machine learning by IBM's Watson from 40,000 forum posts in previous courses) as a teaching assistant. Students could not distinguish between it and real tutors in ability to respond to student queries (Korn, 2016).
- *Big data analytics.* Different kinds of data and information can be brought to bear for assessment, validation or security purposes. For instance, data generated by learning platforms (log stream data, and data generated by tools such as surveys, eye-gaze monitors, facial recognition, and so on) can be used to assess generic skills such as collaboration (Griffin et al, 2012), creativity (Shute and Ventura, 2013), and metacognitive skills such as capacity to learn (Milligan and Griffin, in press). The case studies illustrate various uses of technologies relying upon key stroke patterns (Coursera) or videoing and monitoring of students during invigilated examinations (WGU).
- *Automated monitoring and feedback to assessors.* The psychometric and educational quality of assessment can be authenticated using embedded back-end technologies that assist in distinguishing good-quality from poor-quality assessments and in improving those assessments.
- *Adaptive assessment.* Candidates can be offered tasks calibrated to their developmental level, thus avoiding the

discouragement inherent in tasks that are too difficult or too easy, and targeting teaching more accurately. For example, GFA announced its deployment of the ALEKS (Assessment and Learning in Knowledge Spaces) adaptive software program from McGraw-Hill Education in its Algebra & Problem Solving MOOC. ALEKS uses artificial intelligence and cognitive computing to provide 'personalised instruction', using 'real-time feedback and inherent motivators' to 'generate improvements in retention, success and confidence'.

The case study institutions have also referenced a range of other technologies aimed at supporting better credentialling. Concept maps have been used to assist learners to visualise learning requirements (ASUO with Knewton). Technology to support communication of and stackability and portability of credentials has been provided by Mozilla OBI and Credly. Systems to allow students, alumni, and professional development customers to manage life-long credential portfolios for their CPD clients have been proposed by DeakinSync.

In each of these cases, therefore, deployment of new generation assessment and credentialling technologies has been used to augment quality of the credential. The case studies are littered with descriptions of new generation tools embedded in the platforms, which are seen as providing instant, automated, responsive feedback to learners; support better teaching; provide for a wider range of evidence for a wider range of learning outcomes; support validity arguments; and better support credential holders and clients with their own aspirations and needs.

## Theme 10: Technology partnerships

Many of the case studies reference partnerships – on terms unspecified – with technology providers as a key means of developing their own capabilities to support the new generation of technologies. Universities use MOOCs to support outreach to global open markets, and depend upon MOOC partners to provide the means (and to take the technological risk). The edX platform supports a particularly generative open source community to support educational and technological development. The Global Freshman Academy uses the edX platform, together with applications such as ALEKS. Its parent organisation (ASUO) cites partnerships in technology and assessment with organisations including Pearson and Knewton as central to its innovative approach to competency-based curriculum and assessment in the GFA. The ASUO is located in the Scottsdale Innovation Centre, home to many tech innovation and education companies. DeakinDigital has partnerships with IBM and Hudson, among others. Institutions not profiled here, such as Swinburne University and the University of Texas, depend on the technology of partners (Seek and Academic Partnerships respectively) to help scaling services in digital courses. Most institutions using badging depend on organisations such as Mozilla OBI, Credly, or Acclaim to extend their capability in marketing, and assessment. Georgia Tech lists partnerships with IBM and Udacity, while Udacity is provided with technical support by AT&T.

In each of these cases, institutions are developing capacity and technology infrastructure to support high-quality assessment, reporting, and certificating

practice. They seem not to be seeking to evolve the current digital environment, or even to break new technological ground, but rather to use the partnerships with technology developers to meet their distinctive and emergent educational needs.

## Conclusion

There remain many questions about online and other forms of digital delivery, especially those relating to whether or not digital technologies will support productive reforms to the learning processes in schools and other institutions. The case studies made it clear that warrants about improved student learning are built around a particular constellation of inter-related practices in assessment, credentialling and recognition. Key directions include the following.

- *Adoption of competency-based expressions of broad learning outcomes.* In this approach, learning outcomes in courses are aimed at improving competence of individuals of value to employers, industry groups, or professions, in the interests of improved productivity, or professional standards. Learning outcomes are expressed at a granular level that enables stakeholders to understand relatively precisely what a credential holder knows and can do. Outcomes are valued in the areas of generic capabilities in ‘soft skills’, and/or specific professional skills, and/or metacognitive learning skills, as well as the more familiar academic knowledge and understanding. Curriculum and assessment standards are tied to professional, employer, or industry standards.

There remain many questions about online and other forms of digital delivery, especially those relating to whether or not digital technologies will support productive reforms to the learning processes in schools and other institutions.



Micro-credentials are of value to the extent that they are stackable and portable and attract formal or informal recognition by particular employers, industry and professional groups, and other providers.

- *Entering into the micro-credentialling ecosystem.* Micro-credentials are of value to learners and other stakeholders because they are suited to the networked environment of modern employment practice, in which detailed evidence is required about what people know or can do. Micro-credentials are easily communicated by social media and employment sites. They contain information designed to inform, verify and provide evidence of what it is that an individual has learned or can do, and the standards attained. Credentialling is not only of what has been covered in teaching but what can be built upon, and often relies on prior informal learning. Micro-credentials are of value to the extent that they are stackable and portable and attract formal or informal recognition by particular employers, industry and professional groups, and other providers.
- *Re-imagining the educational opportunities provided by the increasing power of modern digital tools.* Technology-supported approaches to digital learning are developing apace in a range of areas. Developments are evident in digital portfolio management, in cognitive computing and machine learning, and in learning analytics to exploit huge increases in the range and types of learning-related digital data. These developments are applied in imaginative new ways to improve the validity, relevance, and educational value of assessment, to support warrants for a wider range of learning outcomes, and to improve the effectiveness and value of credentialling.

The consistency with which these themes recur suggests that any institution might consider their appropriateness for its own digital strategy.

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## Endnotes

1. For example, see a summary of Graduate Attributes of the University of Melbourne, available at [www.qmul.ac.uk/docs/gacep/44631.pdf](http://www.qmul.ac.uk/docs/gacep/44631.pdf).
2. An example is the Campus Policy Framework established by the Badge Alliance in 2015: [docs.google.com/document/d/1Lv002M3Ajfj2D2CBtHdpAnUqKB-DUY3Q9C2DWkQbZAw/edit#heading=h.xlo013e1ldch](https://docs.google.com/document/d/1Lv002M3Ajfj2D2CBtHdpAnUqKB-DUY3Q9C2DWkQbZAw/edit#heading=h.xlo013e1ldch).
3. See a press release on providing badges as a common currency for corporate education, retrieved from [www.imsglobal.org/sites/default/files/pressreleases/IMSPR20150421.pdf](http://www.imsglobal.org/sites/default/files/pressreleases/IMSPR20150421.pdf).
4. More information about professional standards in Australia is available from the Professional Standards Council: [www.psc.gov.au/consumer-information/what-is-a-scheme](http://www.psc.gov.au/consumer-information/what-is-a-scheme).
5. See the use of professional standards for CPD for the Pharmaceutical Society of Australia retrieved from [www.psa.org.au/download/standards/professional-practice-standards-worksheet.pdf](http://www.psa.org.au/download/standards/professional-practice-standards-worksheet.pdf).
6. See guidelines for professional development from the Victorian Institute of Teachers referencing the Australian Standards for Teachers: [www.vit.vic.edu.au/registered-teacher/renewing-my-registration/professional-development](http://www.vit.vic.edu.au/registered-teacher/renewing-my-registration/professional-development).
7. College Affordability Guide: [www.collegeaffordabilityguide.org/college-for-free/moocs-that-offer-credit-by-exam/](http://www.collegeaffordabilityguide.org/college-for-free/moocs-that-offer-credit-by-exam/).
8. As quoted in the *New York Times*, 2012, retrieved from [www.nytimes.com/2012/09/08/education/studies-show-more-students-cheat-even-high-achievers.html?\\_r=1](http://www.nytimes.com/2012/09/08/education/studies-show-more-students-cheat-even-high-achievers.html?_r=1).
9. See, for example, ProctorU, a service providing online proctoring for any provider: [www.proctoru.com/index.php](http://www.proctoru.com/index.php).
10. Adaptive learning systems are criticised for promoting the notion of the isolated individual, in front of a technology platform, mastering concrete and sequential content; see Ma, W, Adesope, W O, Nesbit, J C, and Liu, Q S (2014), 'Intelligent tutoring systems and learning outcomes: A meta-analysis', *Journal of Educational Psychology*, **106**, 4, p 901–918.

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L-R: Sandra K Milligan, Gregor E Kennedy and David Israel

## About the Authors

**Sandra K Milligan** is Director and Principal Fellow of the Assessment Research Centre at the Melbourne Graduate School of Education, University of Melbourne. Sandra's current research interests focus on assessment, micro-credentialling and warranting of hard-to-assess learning. Her most recent award-winning research examined opportunities for use of 'big data' and developmental assessment approaches on digital learning platforms, to support assessment of higher-order learning skills. The skills, including so called '21st Century skills', or learning skills, have hitherto been difficult for classroom teachers to assess. Sandra has an unusually wide engagement with the education industry, and in educational research. Originally a teacher of science and mathematics, she is also a former Director of Curriculum in an Australian state education department, and has held senior research, management and governance positions in a range of educational organisations, including government agencies, not-for-profits, small start-up businesses and large, listed, international corporations. She was co-founder of The Good Universities Guide series, and has a background in technology commercialisation in education. She is the Convenor of a Melbourne University MOOC targeting professional learning for teachers in the area of assessment and teaching of 21C skills, which has to date enrolled over 30,000 teachers worldwide.

**Gregor Kennedy** is Pro Vice-Chancellor (Teaching and Learning) and Director, Centre for Study of Higher Education, University of Melbourne. In his PVC role Gregor leads the University's strategy in teaching, learning and assessment, curriculum innovation, educational technologies, learning analytics, and the use of physical and virtual space. Gregor has spent over 15 years conducting and overseeing research and development in educational technology in higher education and leads the educational technology research group within the MCSHE. His current research interests include students' motivation and self-regulation; interaction and engagement in digital learning environments; understanding confusion and the provision of feedback to students engaged in digital tasks, the use of 3D immersive simulation for learning; and the use of learning analytics for improved learning design, teaching and student support. Gregor has published widely in these areas, is a past editor the Australasian Journal of Educational Technology and serves on a number of editorial boards. He is a regular invited and keynote speaker at national and international conferences on educational technology and higher education.

**David Israel** is the Director of Educational Innovation and Commercial Development at the University of Melbourne. In his current role he helps drive the teaching and learning strategy of the University through development and implementation of the University's online education programs, its campus based elearning initiatives, and its endeavours to extend its reach through partnerships in curriculum and content.

He has worked in the higher education sector for most of the last 30 years and has helped take university IP to market through licences and start-up company creation and has lead innovation strategy across a wide range of domains.

## About the Paper

The authors report and comment on findings from a survey, undertaken in 2016 on behalf of the University of Melbourne, of some of the most prominent and/or innovative developments in post-school online assessment and credentialling, focusing particularly on uses of digital technologies and their application in the continuing professional development sector. Drawing on a series of case studies and 'snapshots', they identify ten emergent themes and conclude that many questions remain to explore, especially relating to whether or not, and how, digital technologies will support productive reforms to learning and assessment in schools and other institutions.

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