NMC **Horizon Project**

2015 NMC Technology Outlook
Higher Education in Ireland

A Horizon Project Regional Report

2015 NMC Technology Outlook for Higher Education in Ireland

A Horizon Project Regional Report

2015 NMC Technology Outlook for Higher Education in Ireland
A Horizon Project Regional Report

is a collaboration between

The New Media Consortium (NMC),
National Institute for Digital Learning (NIDL) at Dublin City University,

and

Irish Learning Technology Association (ILTA)

Citation

Johnson, L., Adams Becker, S., Cummins, M., Estrada, V., and Freeman, A. (2015). 2015 NMC Technology Outlook for Higher Education in Ireland: A Horizon Project Regional Report. Austin, Texas: The New Media Consortium.

Cover photo via BigStock Photography

Executive Summary

The *2015 NMC Technology Outlook for Higher Education in Ireland: A Horizon Project Regional Report* is a collaborative research effort between the NMC, National Institute for Digital Learning (NIDL) at Dublin City University, and the Irish Learning Technology Association (ILTA) to inform Irish higher education leaders and decision-makers about important developments in technologies supporting teaching, learning, and creative inquiry in higher education across the country.

Three major reports focused on bringing European and Irish universities and institutes of technology into the future provided an important foreground for this project: 1) the High Level Group on the Modernisation of Higher Education's "Report to the European Commission on New Modes of Learning and Teaching in Higher Education;" 2) the National Forum for the Enhancement of Teaching and Learning's "Principles and First Insights from the Sectoral Consultation on Building Digital Capacity in Irish Higher Education: Digital Roadmap - Phase 1;" and 3) the National Forum for the Enhancement of Teaching and Learning's "Teaching and Learning in Irish Higher Education: A Roadmap for Enhancement in a Digital World 2015-2017."

All of the research underpinning the *2015 NMC Technology Outlook for Higher Education in Ireland* makes use of the NMC's Delphi-based process for bringing groups of experts to a consensus viewpoint, in this case around the impact of developments in technology on teaching, learning, or creative inquiry in Irish higher education over the next five years. The same process underlies the well-known *NMC Horizon Report* series, which is the most visible product of an on-going research effort begun more than 13 years ago to systematically identify and describe emerging technologies likely to have a large impact on education around the globe.

In the effort that took place from January through March 2015, a carefully selected panel of experts and thought leaders was asked to consider hundreds of relevant articles, news, blog posts, research, and project examples as part of the preparation that ultimately pinpointed the most notable developments in technology, trends, and challenges for Irish higher education over the next five years. Known as the 2015 Horizon Project Ireland Expert Panel, that group of thought leaders consists of knowledgeable individuals, all highly regarded in their fields. Collectively the panel represents a range of diverse perspectives across Irish higher education. The project has been conducted under an open data philosophy, and all of the secondary research and discussions can be viewed at ireland.wiki.nmc.org. The precise research methodology employed in producing the report is detailed in a special section found at the end of this report.

The expert panel identified the top 10 key trends, the top 10 significant challenges, and 12 important developments in educational technology. Each of the 12 developments in educational technology are profiled, each on a single page that describes and defines the technology, and are ranked as very important for Irish higher education over the next year, two to three years, and four to five years. Every page opens with a definition of the highlighted technology, outlines its educational relevance, points to several real-life examples of its current use, and ends with a short list of additional readings for those who wish to learn more. Preceding those discussions are sections that detail the expert panel's top ranked trends and challenges, illuminating why they are seen as highly influential factors in the adoption of technology across the country.

The three key sections of this report constitute a reference and straightforward technology-planning guide for educators, institutional leaders, administrators, policy-makers, and technologists. It is our hope that this research when interpreted alongside other major reports, including the annual "Innovating Pedagogy Report" produced by the Institute of Educational Technology at the UK Open University, will help to inform the choices that institutions are making about technology to improve, support, or extend teaching, learning, and creative inquiry in Irish higher education.

Introduction

Higher education institutional leaders across Ireland have made great strides over the past five years towards integrating emerging technologies and strategies into teaching and learning. The next five years will be instrumental in furthering this mission. As stated by former president of Ireland Mary McAleese in the "Roadmap for Enhancement in a Digital World" report, "It is clear that there is a serious collective commitment among Irish higher education institutions to work together to embrace technology in education in order to build a stronger educational future." (Page iii.)

Indeed, the NMC Horizon Project and the 2015 Horizon Project Ireland Expert Panel recognise that technology adoption in Irish higher education is accelerated by trends in policy, leadership, and practice. Therefore, key trends frame the discussion of technology use in Irish higher education institutions. Similarly, a number of challenges are impeding the proliferation of digital tools, and the panel has identified a set of significant challenges that distinctly reflects the current obstacles facing Irish higher education over the coming five years. The top three trends and challenges from those longer lists are included in the related tables in this summary, and are organised by categories described in the next sections of this report.

As Table 1 below illustrates, the choices of the Ireland experts overlap in interesting ways with those who contributed to the *NMC Horizon Report > 2015 Higher Education Edition,* which looked at technology uptake from a global perspective, and the *2015 NMC Technology Outlook for Australian Tertiary Education*, which provides perspective on technology, trends, and challenges across Australia — altogether a group of 156 acknowledged experts.

Table 1: Top-Ranked Trends Across Three NMC Horizon Research Projects

NMC Horizon Report 2015 Higher Education Edition	2015 Technology Outlook for Higher Education in Ireland	2015 Technology Outlook for Australian Tertiary Education
Rethinking Learning Spaces	Rethinking the Roles of Educators	Increasing Use of Hybrid/Blended Learning
Increasing Use of Hybrid/Blended Learning	Increasing Use of Hybrid/Blended Learning	Redesigning Learning Spaces
Growing Focus on Measuring Learning	Rise of Digital Delivery	Growing Focus on Measuring Learning

The highest ranked trend by the Ireland panel surfaces the evolving expectations of educators — a concept that was deemed as a challenge by the two other panels. Higher education institutions in Ireland are embracing the new roles being undertaken by lecturers and academics as guides and mentors that help facilitate more active learning experiences. The "Digital Roadmap" recommended that universities and institutes of technology across Ireland continue piloting more team-based approaches between educators and students. All three panels are observing the increasing use of hybrid and blended learning models, as evidenced by the inclusion of the flipped classroom as an important development in both reports.

Unique to Ireland panel discussions, but related to the notion of hybrid learning, was the integration of digital delivery as a common and expected element of university life. For example, the National Institute for Digital Learning at Dublin City University supports the design and development of digital content that is optimal for fully online delivery for people living

throughout Ireland. There are also increasing efforts by institutions to develop hybrid digital methods for ongoing professional development for academic staff.

Horizon Project panels in general have agreed that trends like these are clear drivers of technology adoption; the 2015 Ireland panel especially saw such a linkage. At the same time, these panels of experts also agree that technology adoption is often hindered by both local and systemic challenges, which are grounded in everyday realities that make it difficult to learn about, much less adopt, new tools and approaches.

Table 2: Top-Ranked Challenges Across Three NMC Horizon Research Projects

NMC Horizon Report 2015 Higher Education Edition	2015 Technology Outlook for Higher Education in Ireland	2015 Technology Outlook for Australian Tertiary Education
Integrating Technology in Teacher Education	Under-resourced Institution Infrastructure	Personalising Learning
Improving Digital Literacy	Scaling Teaching Innovations	Rethinking the Roles of Educators
Creating Authentic Learning Opportunities	Improving Digital Literacy	Creating Authentic Learning Opportunities

As noted in Table 2, above, both the Ireland and global panels agreed that improving digital literacy among teachers and students is a great challenge, and will rely on better integration of ICT in curriculum and pedagogy design, along with academic development initiatives and initial teacher education programmes. In order for emerging technologies to be creatively leveraged by students in courses, lecture halls, and virtual learning environments across Ireland, lecturers and support staff need to be confident and effective in applying them. To address this challenge, the "Building Digital Capacity in Irish Higher Education" roadmap includes strategies for deploying sufficient training and supporting programmes, which this report confirms are crucial to wider implementation.

At the top of the list of challenges facing Irish universities and institutes of technology is the lack of sufficient institution resources and infrastructure to effectively adopt and integrate emerging technologies. It is difficult for academics, researchers, and students to innovate in the face of outdated infrastructure, inadequately resourced virtual learning environments and lack of investment in new and emerging media. Compounding this challenge, the expert panellists cited that in many cases, lecturers do not have access to as high-quality and new technologies as their students own. Low-cost solutions, such as cloud computing, are making it more possible for people both within and outside of institutions to connect with each other and create and store digital content, but more effort and resources are required to take advantage of these opportunities.

The Ireland panel also recognised the scaling of teaching innovations as a challenge that is hampering the dissemination and implementation of progressive approaches in higher education. Institutional structures do not always reward improvements to teaching and learning models, and furthermore, experimentation and risk-taking are not always valued. In addition, the current funding model for higher education limits efforts by institutions to scale flexible delivery methods for distance learners. Expert panellists believe that solving these challenges will require more equitable funding and involve optimising the use of technology in teaching and learning in collaboration with academic leadership, including better understanding of how to harness the

pedagogical affordances of technology at different levels. Another important dimension is providing support in the mobile, online education, cloud, and BYOD environments that are becoming commonplace.

Fuelled by the key trends and impeded by significant challenges selected by the panel, the 12 important developments in educational technology presented in the body of this report reflect our experts' opinions as to which of the nearly 60 technologies considered will be most important to Irish higher education institutions over the five years following the publication of the report.

The report to the European Commission on the "Modernisation of Higher Education" asserts, "Emerging technologies are already starting to have a transformative effect on higher education provision. There is every reason to harness the potential of these developments in the service of high quality higher education. But to do that effectively we need to both widen and deepen our understanding of how these new technologies and pedagogical tools can be an integral part of the way higher education is delivered." (Page 14.) The 12 important developments selected by the 2015 Horizon Project Ireland expert panel were researched and grounded in real in-practice examples from Irish institutions to depict their impact and applications in the field thus far.

All three of these projects' expert panels strongly agree that the Bring Your Own Device movement and the flipped classroom will likely tip into mainstream use within the next year — a trend that spans education across the world.

There are also several other overlaps, indicating Ireland's close alignment with prevalent Australian and global trends. The three panels believe that adaptive learning technologies will be in widespread practice in four to five years, as governments and institutional leaders recognise the potential of data to inform teachers about student progress on a deeper level and tailor lessons to better meet individual needs. Some institutions in Ireland are currently piloting programmes and services that provide adapted content to students in real time. For example, the PredictEd initiative at Dublin City University is using data from Moodle to provide first-year learners with a weekly indication of their progress.

Table 3: Comparison of "Final 12" Topics Across Three NMC Horizon Research Projects

NMC Horizon Report 2015 Higher Education Edition	2015 Technology Outlook for Higher Education in Ireland	2015 Technology Outlook for Australian Tertiary Education
Time-to-Adoption Horizon: One Year or Less		
Bring Your Own Device Flipped Classroom Learning Analytics Mobile Apps	Bring Your Own Device Flipped Classroom Mobile Learning Online Learning	Bring Your Own Device Cloud Computing Flipped Classroom Learning Analytics
Time-to-Adoption Horizon: Two to Three Years		
Collaborative Environments Games and Gamification Makerspaces Wearable Technology	Badges/Microcredit Games and Gamification Learning Analytics Open Content	Badges/Microcredit Mobile Learning Open Licensing Wearable Technology
Time-to-Adoption Horizon: Four to Five Years		
Adaptive Learning Technologies Flexible Displays The Internet of Things Wireless Power	Adaptive Learning Technologies Collaborative Environments Digital Identity Social Networks	Adaptive Learning Technologies Augmented Reality Quantified Self Telepresence

Both the Ireland panel and the Australia panel deemed badges and microcredit as an important digital initiative that will be accelerated over the next two to three years. Alternative credentialing is perceived as a way to recognise both academics and students for acquiring new knowledge and

skills as they pursue co-curricula and informal learning methods. As many digital badges are now open-source, they can increasingly be displayed online where the user chooses, although any strategy in this area must be purposively aligned with other institutional projects and major European badging initiatives.

A related digital strategy, emphasised by the Ireland and global panels, is the use of games and gaming mechanics for teaching and learning. More courses are leveraging simulations and serious games to provide students with more engaging and immersive experiences. The annual Irish Symposium on Game-Based Learning regularly brings together teachers, lecturers, students, and researchers to disseminate research and exchange ideas and best practices on the use of games and gamification in the classroom.

There is also a difference between a perceived time-to-adoption horizon. The Ireland panel sees learning analytics as a mid-term horizon topic, while the other two panels believe it is closer to mainstream adoption. Throughout the discussions between panellists on the wiki as well as the research process, it was evident that there is more work to be done in the field of data mining to better establish learning analytics at Irish institutions. The expert panellists cited ethical and privacy concerns as a barrier to its growth.

A number of unique choices distinguished the perspectives expressed by the Ireland panel from their counterparts — particularly on the far-term horizon. Collaborative environments are a major topic of conversation in Ireland, and expert panellists believe they are essential for facilitating active participation in courses through different activities in online spaces for distance students. The role of collaborative technologies, both synchronous and asynchronous, underpins several key elements in an evolving multi-campus architecture across Ireland, including supporting the communications and networking requirements of cross-institution teams.

The panel also highly ranked digital identity as an important far-term development worth watching. This area may be influenced by recent high profile efforts by the European Commission to ensure the protection of personal data. As institutions in Ireland develop virtual learning environments, attaching student participation and interactions to a single identity so their work can be easily tracked and accessed over time may become increasingly important concept. The exploration of digital identity also calls for institutional leaders to consider how multiple identities can be most effectively managed. Similarly, the inclusion of social networks signifies a growing interest in moving and tracking learning discussions online. More academic staff are turning to Twitter and other networks for informal professional development as they are able to follow relevant hashtags and field experts, which raises questions about the blurring of personal and professional identities — and potentially matters of academic freedom.

These points and comparisons provide an important context for the main body of the report that follows.

Key Trends Accelerating Technology Adoption

The developments in technology featured in the NMC Horizon Project are embedded within a contemporary context that reflects the realities of the time, both in the sphere of education and in the world at large. To assure this perspective, each panel member researches, identifies, and ranks key trends that are currently affecting policy, leadership, and practice in higher education across Ireland, and uses these as a lens for the work of predicting the uptake of emerging technologies. These ten trends, which the panel agreed are very likely to strongly influence technology planning and decision-making over the next five years, were ranked in order of importance by the expert panel, with the first trend listed being deemed the most impactful.

1. Rethinking the Roles of Educators. Although traditional large group teaching will continue to be an important part of teaching in higher education, academics in Ireland are increasingly expected to be adept at a variety of ICT-based and other flexible learning approaches. These include new forms of content delivery, learner interaction, and assessment; collaboration with other lecturers; the routine use of technologies; and guiding and mentoring. Since 2011, the "National Strategy for Higher Education to 2030" report has called for Irish educators to adopt flexible models that promote new practices that integrate active learning and critical thinking into standard and consistent practices. This line of discussion has stimulated the consultation process for the creation of a National Professional Development Framework that is being undertaken by Ireland's National Forum for the Enhancement of Teaching and Learning in Higher Education.

2. Increasing Use of Hybrid/Blended Learning Designs. Perceptions of online learning have been shifting in its favour as more learners and educators in Ireland see it as a viable alternative to some forms of face-to-face learning. The advent of MOOCs may be a factor in online learning gaining increasing credibility amongst traditional Irish institutions. Drawing from best practices reported by the panel in online and face-to-face methods, blended learning is on the rise at Irish higher education institutions such as Dublin City University, Maynooth University, St. Nicholas Montessori College, and Trinity Dublin College. The affordances hybrid/blended learning offers are now well understood, and its flexibility, ease of access, and the integration of sophisticated multimedia and technologies are high among the list of appeals.

3. Rise of Digital Delivery. Irish higher education institutions have experienced major growth in the use of online learning management systems (LMS) and virtual learning environments over the past few years. This trend is helping expand access to learning experiences and resources for students throughout Ireland. Student engagement with digital content has been an important focus of Dublin City University for some time, with an investment in a "Digital Campus" a key aspect of their "Strategic Plan 2012-2017." As a result of this investment, every week thousands of students routinely use "Loop," their online learning environment, to discuss course topics and access study materials. Additionally, many institutions leverage the Moodle LMS, and in May 2015, DCU hosted the "MoodleMoot" conference for Ireland and the UK.

4. Shift from Students as Consumers to Students as Creators. A shift is taking place in the focus of pedagogical practice in universities and institutions of technology in Ireland as students across a wide variety of disciplines are learning by making and creating rather than from the simple consumption of content. Creativity, as illustrated by the growth of user-generated videos, maker groups, and crowdfunded projects, is increasingly the means for active, hands-on learning. Immersing students in activities that enable them to create their own understanding of a concept has far greater learning value than when passively or "engagingly" consuming. Indeed, National University of Ireland, Galway's Hardiman Library is currently soliciting ideas from students and staff about what their makerspace should contain.

5. Growing Focus on Measuring Learning. There is an increasing interest in using data to personalise the learning experience, for ongoing formative assessment of learning and for performance measurement. This interest is spurring the development of a relatively new field — data-driven learning. Key elements of this trend are learning analytics and adaptive learning, processes of gathering and analysing large amounts of detail about individual student interactions in online learning activities to provide crucial insights into student progress. In Ireland, CCKF Inc. is working on a project with Career Education on the creation of adaptive learning tools.

6. Redesigning Learning Spaces. New forms of teaching and learning require new spaces for teaching and learning. More institutions are helping to facilitate these emerging models of education, such as the flipped classroom, by rearranging learning environments to accommodate more active learning. Both formal and informal educational settings are increasingly being designed are increasingly designed to facilitate project-based interactions with attention to mobility, flexibility, and multiple device usage. This point is recognised in the "Digital Roadmap," and in September 2015, the HEIR 8th Annual UK and Ireland conference will feature a Communities of Engagement track that will include presentations on the redesigning of learning spaces.

7. Increase in E-Portfolios Created by Learners. There is increasing interest in learners creating their own e-portfolios and owning them beyond the course of their formal education. Although they are not yet fully realised within academic development and personal development planning in Irish institutions, their potential is beginning to be explored at Trinity College Dublin and Dublin City University. In accordance with DCU's quality assurance structure, there is evidence the provision of e-portfolio accounts to first year students has placed greater value on co-curricula activities and enhanced the quality of the teaching and learning experience. The expert panel noted that e-portfolio initiatives can improve the capacity of students to review, plan, and take responsibility for their own learning and to understand what they learn, and how they learn it.

8. Proliferation of Open Educational Resources. Defined by the Hewlett Foundation in 2002, open educational resources (OER) are "teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use and re-purposing by others." There has been a rise in free online services, including TED talks and Wikipedia. Advocates of openness have worked towards a common vision that defines OER as not just free in economic terms, but also in terms of ownership and usage rights. The "Irish Open Access Repositories Support" project is a government-funded project tasked with building OER repositories and includes seven Irish institutions and the Dublin Institute of Technology.

9. Advancing Cultures of Change and Innovation. Many thought leaders have long believed that higher education institutions can play a major role in the growth of national economies and living standards more generally. In order to foster innovation and adapt to economic and societal needs, institutions must be structured in ways that allow for flexibility, and spur creativity and entrepreneurial thinking. There is a growing consensus among many thought leaders that higher education leadership and curricula could benefit from agile start-up models. The Ryan Academy at DCU and the Innovation Academy at College Dublin helps empower students to think differently by promoting entrepreneurial and creative thinking around real-world problems.

10. Increasing Preference for Personal Technology. Both lecturers and students want to use their own technology for learning more and more, mirroring a trend that has been in the workplace for some time. There is an opportunity cost associated with being given access to a computer that cannot be personalised with new applications, tools, or other resources. Utilising one's own device has become something deeply personal, and very much an extension of someone's personality and individual approach to learning. To support their BYOD initiatives, many institutions such as National University of Ireland, Galway, are currently upgrading their infrastructure to expand Wi-Fi access and security.

Significant Challenges Impeding Technology Adoption

Along with the trends discussed in the preceding section, the expert panel noted a number of significant challenges faced in higher education across Ireland that are impeding the uptake of emerging technologies. Because not all challenges are of the same scope, the discussions were framed by three categories defined by the nature of the challenge. The NMC Horizon Project defines solvable challenges as those that we both understand and know how to solve; difficult challenges are ones that are more or less well understood, but for which solutions remain elusive. Wicked challenges, the most difficult, are categorised as complex to even define, and thus require additional data and insights before solutions will even be possible. The expert panel ranked challenges in order of significance, with the first challenge listed being deemed the most prominent.

1. Under-resourced Institutional Infrastructure. Critical institutional infrastructures are under-resourced, and in Ireland, it is cited as one of the major reasons for the decline in university rankings. Rather than encouraging researchers to build on and extend core resources, leverage shared file systems, and open accessible service APIs, institutions are narrowing their focus to what they perceive as the minimal subset of enterprise services they can afford to sustain. As a result, educators are often trying to design new, innovative learning models that must be integrated with outdated, pre-existing technology and virtual learning environments.

2. Scaling Teaching Innovations. Innovation springs from an institutional culture that supports risk-taking and the freedom to experiment with new teaching methods and educational technologies. However, the challenge is to connect these islands of innovation and resource them accordingly so they can be adopted more widely within and beyond institutions. A prevalent aversion to change limits the diffusion of new ideas, and too often discourages experimentation. Dublin Institute of Technology's Higher Education Policy Research Unit suggests that Irish higher education institutions need to shift their attitudes and create new mission statements that favour more risk-taking over compliance, although, sector wide drivers including staffing and funding restrictions also influence the development of a culture of innovation.

3. Improving Digital Literacy. With the proliferation of the Internet and mobile devices, the traditional view of literacy as the ability to read and write has expanded to encompass understanding digital tools and information. This new category of competence is affecting how Irish institutions address literacy issues in their curriculum objectives and teacher development programmes. Acknowledging this challenge, the "Building Digital Capacity in Irish Higher Education" roadmap includes a commitment to the fostering of digital literacy among teachers and students. The challenge will be to ensure that future efforts in this area do not adopt a narrow instrumentalist approach, as the use of technology for teaching and learning is far more complex.

4. Engaging with the Ethical, Privacy, and Ideological Aspects of Learning Analytics. The expert panel agreed that a significant discussion about the controversial dimensions of learning analytics, such as ethics, ideology, and privacy, is needed as Irish higher education institutions begin implementing new forms of data collection. Students should be allowed to engage with failure in a supportive environment as a part of the learning process without the risk of leaving a negative digital footprint behind. To address this challenge, data researchers in Ireland have introduced a "Magna Carta for Data" that calls for a framework that balances concern over privacy infringements against the need for beneficial use of data analytics to improve student outcomes. Nevertheless, more attention needs to be given to these ethical and privacy concerns in the future.

5. Integrating Technology in Teacher Education. Teacher professional development still does not fully acknowledge that digital literacy continues its rise in importance as a key skill in every discipline and profession. The lack of formal training for lecturers is being offset through informal

learning and ad hoc professional development, but higher education is far from seeing digital literacy as a norm. A study being undertaken by the College of Engineering and the Built Environment at the Dublin Institute of Technology identified this lack of teacher training as one of the biggest challenges institutions face when implementing and using new technologies.

6. Creating Authentic Learning Opportunities. Authentic learning, especially that which brings real-life experiences into the classroom, is still too uncommon in Irish universities and institutes of technology. Authentic learning is seen as an important pedagogical strategy, with great potential to increase the engagement of students who are seeking some connection between the world as they know it exists outside of the institution, and their experiences that are meant to prepare them for that world. Use of learning strategies that incorporate real life experiences and interactions from community members, such as the Europe Engage project at National University of Ireland, Galway, are examples of approaches that can bring authentic learning into the classroom.

7. Blending Formal and Informal Learning. Traditional approaches to teaching and learning with roots in the 18th century and earlier are still very common in many institutions, and often stifle learning as much as they foster it. As the Internet has brought the ability to learn something about almost anything to the palm of one's hand, there is an increasing interest in curiosity-based learning, anytime and anywhere. Informal learning serves to enhance student engagement by encouraging them to follow their own learning pathways and interests. The CAVE Research Centre and Centre for Academic Practice and eLearning at Trinity College Dublin recently partnered with five other European countries to address this challenge by working on policy recommendations on the assessment and recognition of informal/non-formal learning outside the classroom.

8. Competing Models of Education. New models of education are bringing unprecedented competition to the traditional models of higher education where students typically receive instruction by teachers or teaching assistants per credit hour over three or four years, on-campus. Across the board, institutions are looking for ways to provide a high quality of service and more learning opportunities at lower costs. Massive Open Online Courses (MOOCs) are at the forefront of these discussions, and NIDL is actively involved in several European funded MOOC-related projects, and Silgo Institute of Technology has considerable experience in this area. NUI Galway is also exploring this space through a feasibility study that hopes to unite several Irish higher education institutions through the launch of a new online education brand.

9. Keeping Formal Education Relevant. As online learning and free educational content become more pervasive, stakeholders and administrators must seriously consider what Irish institutions can provide that cannot be replicated by other sources. The idea that it is no longer necessary for young people to gain skills that will lead them to gainful employment through formal education is a wicked challenge. There are, however, valuable skills and attitudes that can only be acquired in formal education settings. Soft skills, such as face-to-face communication and collaboration, are essential practices for solving problems in a world that is increasingly interconnected. Addressing this challenge, a representative from the University College Cork recently joined a Global Summit on Student Affairs to discuss the importance of soft skills development to improve employability.

10. Teaching Complex Thinking. It is essential for young people both to understand the networked world in which they are growing up and also — through computational thinking — to understand the difference between human and artificial intelligence, learn how to use abstraction and decomposition when tackling complex tasks, and deploy heuristic reasoning to complex problems. Maynooth University's Department of Computer Science is working to solve the challenge; they created a degree in Computational Thinking that provides hands-on programming skills, advanced problem-solving techniques, and instruction on how students can think analytically when approaching complex problems.

Time-to-Adoption: One Year or Less

Bring Your Own Device

BYOD, also referred to as BYOT (Bring Your Own Technology), refers to the practice of people bringing their own laptops, tablets, smartphones, or other mobile devices with them to the learning or work environment. Intel coined the term in 2009, when the company observed that an increasing number of its employees were using their own devices and connecting them to the corporate network. Since implementing BYOD policies, the company has reported up to 5 million hours of annual productivity gains, a statistic that is compelling many other companies to consider BYOD. In schools, the BYOD movement addresses the same reality; many students are entering the classroom with their own devices, which they use to connect to the school's network. While BYOD policies have been shown to reduce overall technology spending, they are gaining traction more so because they reflect the contemporary lifestyle and way of working. In an article in the *Irish Examiner*, technology company EMC reported that implementing BYOD policies in the workplace gave both the leadership team and employees peace of mind, but acknowledged the importance of developing security measures. Additionally, technology gap issues and platform neutrality are noted challenges to the uptake of this technology-driven practice. Yet a growing number of models in practice are paving the way for BYOD to enter the mainstream in Irish higher education.

Relevance for Teaching, Learning, or Creative Inquiry

- Because BYOD allows students access to the same devices at school and at home, it can extend learning opportunities to times and places outside of the classroom.
- BYOD policies allow students to work with technology with which they are already comfortable and familiar.
- BYOD programmes eliminate the support and other demands placed on universities and institutions of technology that accompany paying for and maintaining institution-provided devices.

Bring Your Own Device in Practice

- At Dublin Institute of Technology, an app called "AtNorth" is accessible on a variety of devices and was developed for students who are registered with the disability service to receive assistive technology advice, as well as to contact the assistant technology officer directly: go.nmc.org/assist.
- The Law Society of Ireland implemented their BYOD initiative using Ruckus Wireless to manage access points across the institution: go.nmc.org/lawsoc.
- The National University of Ireland, Galway secured a contract with Dublin-based Ward Solutions to implement IT security system upgrades that will enable students and staff to securely embrace the university's BYOD initiative: go.nmc.org/nuig.

For Further Reading

The Future of Education is Devices in the Classroom
go.nmc.org/displ
> (Pamela Newenham, *Irish Times*, 24 March 2014.) Belfast-based start-up DisplayNotes developed an app that allows the instructor or specific students to mirror what is on their PC to more than 40 devices at the same time, enhancing instruction in a BYOD classroom.

Students: Bring Your Own Technology to Uni
go.nmc.org/bringto
> (Mirren Gidda, *The Guardian*, 11 April 2014.) This article delves into the current challenges many universities and institutes of technology are facing in implementing BYOD, including creating an infrastructure with sufficient wireless bandwidth, incorporating students' own devices into the learning activities, and engaging them in deep, analytical thinking without distractions of their social networks and other apps.

Time-to-Adoption: One Year or Less

Flipped Classroom

The flipped classroom refers to a model of learning that rearranges how time is spent both in and out of class to shift the ownership of learning from the educators to the students. In the flipped classroom model, valuable class time is devoted to more active, project-based learning where students work together to solve local or global challenges — or other real-world applications — to gain a deeper understanding of the subject. Rather than the instructor using class time to dispense information, that work is done by each student after class, and could take the form of watching video lectures, listening to podcasts, perusing enhanced e-book content, or collaborating with peers in online communities. Students access the online tools and resources any time they need them. Teachers can then devote more time to interacting with each individual. After class, students manage the content they use, the pace and style of learning, and the ways in which they demonstrate their knowledge; the instructor adapts instructional and collaborative approaches to suit their learning needs and personal learning journeys. The goal is for students in Ireland to learn more authentically by doing. The flipped classroom model is part of a larger pedagogical movement that overlaps with blended learning, inquiry-based learning, and other instructional approaches and tools that are meant to be flexible, active, and more engaging for students.

Relevance for Teaching, Learning, or Creative Inquiry

- Flipped classroom concepts and providing students with a more diverse set of learning resources can support self-directed learning.
- More active learning is an important component of the flipped classroom: lectures can be watched with ensuing online discussions unfolding at home, while teachers can use class time for hands-on activities or trips outside of the building.
- The online component of the flipped classroom enables students to repeat vital learning activities, such as re-watching video lectures and running virtual experiments as often as needed, in order for them to fully grasp the subject matter.

Flipped Classroom in Practice

- The Athlone Institute of Technology held a flipped classroom event to address challenges faced by students and give examples of successful strategies: go.nmc.org/athl.
- A computing lecturer at National College of Ireland earned a President's Award for Distinguished Teaching for her flipped classroom approach. She created her own YouTube channel to reach students outside of class so that class time can be devoted to designing and creating websites: go.nmc.org/ncirl.
- The University College Cork converted a third-year history course from a traditional lecture-based format to a blended flipped classroom format: go.nmc.org/history.

For Further Reading

The Flipped Classroom – Insights from the 2014 Blackboard Teaching & Learning Conference
go.nmc.org/insi
> (Ross, Tel@Tees, 15 May 2014.) A lecturer who attended the 2014 Blackboard Teaching and Learning Conference held at The University College of Dublin shares knowledge gained regarding the implementation of a flipped classroom approach.

The Ongoing Evolution of Learning: A Biologist's Continued Experiments with the Flipped Classroom
go.nmc.org/biol
> (Dr. Jeremy Pritchard, Panopto Blog, 20 March 2014.) The Head of Education at the University of Birmingham flipped his science courses, finding that some key enablers to his approach include lecture capture and linking pre-recorded content to assessments.

Time-to-Adoption: One Year or Less

Mobile Learning

We are in the midst of a complete shift in the devices we use. As smartphones and tablets become more capable and user interfaces more natural, old methods of computing seem place-bound and much less intuitive. People increasingly expect to be connected to the Internet and the rich tapestry of knowledge it contains wherever they go, and the majority of them use a mobile device to do so. In September 2014, Comreg reported that smartphone usage in Ireland had reached an all-time high, with a 59% penetration rate — a nearly 15% increase from the previous reporting period. Almost 70% of Irish households subscribe to mobile broadband plans. The unprecedented evolution of these devices and the apps that run on them has opened the door to myriad uses for education. Learning institutions all over the world are adopting apps into their curricula and modifying websites, educational materials, resources, and tools so they are optimised for mobile devices. The significance for teaching and learning is that these devices have the potential to facilitate almost any educational experience, allowing learners to organise virtual video meetings with peers all over the world, use specialised software and tools, and collaborate on shared documents or projects in the cloud, among many other things. Although there are still likely many uses that have not been realised yet, over the past several years mobile learning has moved quickly from concept to reality.

Relevance for Teaching, Learning, or Creative Inquiry

- As a one-to-one solution, mobiles present an economic, flexible alternative to laptops and desktops due to the devices' lower cost, greater portability, and access to apps.
- Mobile apps with built-in social features enable learners to share their questions or findings with each other in real time. For example, productivity apps such as Evernote and Dropbox make it possible to exchange notes, assignments, drawings, and videos.
- Students can leverage the cameras, microphones, and other tools inherent in mobiles to do field work or create rich media. This is especially convenient for work done outside of the classroom as students can record interviews, collect data for experiments, and more.

Mobile Learning in Practice

- At the National University of Ireland, Galway, teachers-in-training are using tablets to develop Irish language digital textbooks that support instruction in primary and secondary schools throughout the country: go.nmc.org/galway.
- The disability services department at the University of Limerick offers training that helps educators use assistive, mobile technology with special needs students: go.nmc.org/limerick.
- The Leeds School of Medicine integrated students' iPhones for accessing assessment apps that help clinicians and learners stay in touch: go.nmc.org/leeds.

For Further Reading

After the Unbundling - What's Next for Higher Education
go.nmc.org/ericc
(Ericsson, 27 November 2014.) Industry experts predict that opportunities to improve higher education will be reflected in mobile interactions through online environments.

Mobile Learning in Higher Education: Mobilizing Staff to Use Technologies in Their Teaching
go.nmc.org/zwtwc
(Sandy Schuck, *eLearn Magazine*, March 2015.) An academic relates their experiences developing a programme that trains teachers to use mobile technologies. Establishing a professional learning community and pedagogical framework first proved crucial.

Time-to-Adoption: One Year or Less

Online Learning

Online learning is not new; the category refers to any learning that takes place through web-based platforms, whether formal or informal. The learning can be structured as in traditional courses or entirely self-paced. What has made the topic new is the recent and unprecedented focus on providing learning via the Internet that has been stimulated by the tremendous interest in massive open online courses (MOOCs). Online learning has now "come of age;" increasingly, the design of online learning is specifically intended to encompass the latest research, the most promising developments, and new emerging business models in the online learning environment. At many institutions in Ireland, online learning is an area newly ripe for experimentation — some would argue it is undergoing a sea change, with every dimension of the process open for reconceptualisation. At institutions in Ireland, virtually every aspect of how students connect with institutions and each other to learn online is being reworked, rethought, and redone at a rapid pace.

Relevance for Teaching, Learning, or Creative Inquiry

- As new pedagogies emphasise personalised learning, there is a growing demand for learner-centred online opportunities. Online learning environments, when designed effectively, have the potential to scale globally.
- Online learning makes creative use of educational technologies and emerging instructional approaches, including blended learning, video lectures, and badges.
- When placed online, a diverse set of learning resources is easily accessible to students and can support self-directed learning.

Online Learning in Practice

- In partnership with Arizona State University, Dublin City University recently launched an online Masters degree in Biomedical Diagnostics: go.nmc.org/biodia.
- The Royal College of Surgeons in Ireland uses Moodle to facilitate courses, an online virtual patient simulation about patient care, and blended learning technologies to enhance the learning experience: go.nmc.org/royal.
- Trinity College Dublin launched a six-week MOOC, "Irish Lives in War and Revolution," which will be offered through Open University's FutureLearn: go.nmc.org/dubmooc.
- University College Cork and Dublin Institute of Technology created "Structure-based Organic Chemistry Online Tutorials" for the online teaching and assessment of organic chemistry: go.nmc.org/socot.

For Further Reading

Irish Bid for Online Market
go.nmc.org/irishbid
> (Naomi Powell, *Times Higher Education*, 8 May 2014.) The National University of Ireland is conducting a feasibility study to determine an action plan for online education accreditation, with the goal of establishing a single international brand for Irish online education.

Online Learning in the Irish Context:
go.nmc.org/joint
> (National Institute for Digital Learning, 10 December 2014.) Leaders from Dublin City University's NIDL, UK Open University, and Trinity College Dublin presented "Online Learning at University" for the Joint Committee on Education and Social Protection. The executive summary includes the vision for the integration of online learning.

Time-to-Adoption: Two to Three Years

Badges/Microcredit

Badges are seen as a way to grant certification for informal learning in the form of microcredits. A key aspect of gamification is to build in easy-to-reach incentives, and badges are a simple way to bring that idea to learning. The concept behind badging draws on longstanding ways of learning has been documented in other settings, such as the personal skills and achievement when a Boy or Girl Scout earns a merit badge. The approach is being used in learning environments like the Khan Academy, with promising results. People watch videos on specific subjects and earn new badges by doing so. Mozilla has published an open specification for badging — the Open Badge Initiative (OBI) — that enables providers and users alike to easily display their achievements on the web. Badges can be used as a way to incorporate some of the advantages of game mechanics as participants work through various levels or stages to achieve credentials. While badges are not by any means pervasive in education systems, they appeal to many educators because they are considered to be more authentic signs of knowledge comprehension and skill acquisition than standard tests, grades, or course credits.

Relevance for Teaching, Learning, or Creative Inquiry

- Badges are very flexible and can provide institutional as well as peer- and self-documentation, and if OBI-compliant, even external validation.
- Badges can be used to gamify the learning process, incentivising learners to participate in projects and activities that publicly demonstrate their knowledge, and achieve recognition.
- For academics, the awarding of badges can demonstrate continuing professional development that is achieved through online training academies or informal methods.

Badges/Microcredit in Practice

- The Badge Alliance is a network of individuals and organisations that are working together in support of an open badging system that will foster openness, learner autonomy, and innovation: go.nmc.org/bally.
- The EDGE (Enhancing the Delivery of Guidance and Employability) project of the Limerick and Clare Education and Training Board will explore how open badges can be used in the provision of employability skills development: go.nmc.org/edgelim.
- Funded by the Erasmus + Programme of the European Commission, "Badge Europe!" is an effort to create an Open Badges European professional network through the integration of open badges at the policy level with the Europass initiative: go.nmc.org/beuba.

For Further Reading

The Next Experiment in Education
go.nmc.org/nextex
(Lindsey Tepe, *TIME Magazine*, 11 April 2015.) The Mozilla and MacArthur Foundations are leading the movement to adopt digital badges and micro-credentials as a way to validate skills gained through professional development.

What Can We Learn from the Badging Movement?
go.nmc.org/hech
(Chris Berdik, *The Hechinger Report*, 4 February 2015.) This discussion of badging highlights its potential to validate informal learning experiences and recognise soft skills that are valued in the workplace. According to pilot project leaders and evaluators, the key is to support badges with specific claims and evidence about the learning they represent — among other considerations.

Time-to-Adoption: Two to Three Years

Games and Gamification

The culture around digital games is growing to encompass a substantial proportion of the world's population, with the age of the average gamer increasing every year. The gaming industry is producing a steady stream of games that continue to expand in their nature and impact — they can be artistic, social, and collaborative, with many allowing massive numbers of people from all over the world to participate simultaneously. A 2013 study by the American Psychological Association highlights the cognitive, motivational, emotional, and social impact video games have on human behaviour; this significant body of research underscores the overwhelming potential of games to teach new forms of thought and behaviour. Studies like these are encouraging the uptake of games into the worlds of commerce, the military, and education, among others. Gamification — the integration of gaming elements, mechanics, and frameworks into non-game situations and scenarios for training and motivational purposes — has added another level of complexity to discussions surrounding the potential of games to transform teaching and learning. Although still in its nascent stages in education, the gamification of learning environments is gaining support among educators who recognise that effectively designed games can stimulate large gains in engagement, productivity, creativity, and authentic learning.

Relevance for Teaching, Learning, or Creative Inquiry

- Discovery-based and goal-oriented learning is often inherent in educational games, fostering opportunities for the development of essential social skills such as collaboration and teamwork.
- Gamified learning environments help students keep track of new skills as they gain them and motivate learners to pursue the next level of mastery.
- Simulations and role-playing games allow students to experience real world challenges with room to try new, creative solutions and to learn from failures.

Games and Gamification in Practice

- Cork Institute of Technology worked with the SEGAN Network to organise week-long summer school sessions aimed at both teenagers and adults that cover the development of serious games from concept to design: go.nmc.org/segan.
- Dublin City University partnered with the Centre for Games & Impact at Arizona State University to explore the benefits of games in higher education: go.nmc.org/gamesand.
- The Irish Symposium on Game-Based Learning brings together teachers, lecturers, and students to disseminate research and exchange ideas on the use of games and gamification for enhancing teaching and learning: go.nmc.org/igbl.

For Further Reading

A Framework for Personalised Learning-Plan Recommendations in Game-Based Learning
go.nmc.org/persrec
> (Ioana Hulpus, et al., ARAN, 2014.) This paper describes how game-based learning allows learners to actively build knowledge through experience, which encourages experimentation rather than passive learning.

Individual and Collaborative Performance and Level of Certainty in MetaVals
go.nmc.org/indi
> (Mireia Usart and Margarida Romero, *International Journal of Serious Games, Vol. 1, No. 1*, 2014.) The authors examine the relationship among pedagogical and psychological aspects of game performance and players' metacognitive processes for higher education students based on a collaborative serious game.

Time-to-Adoption: Two to Three Years

Learning Analytics

Learning analytics is an educational application of "big data," a science that was originally used by businesses to analyse commercial activities, identify spending trends, and predict consumer behaviour. The rise of the Internet drove research into big data and metrics as well as the proliferation of web tracking tools, enabling companies to build vast reserves of information they could study and apply to their marketing campaigns. Education is embarking on a similar pursuit into data science with the aim of improving student retention and providing a high quality, personalised experience for learners. Learning analytics research uses data analysis to inform decisions made on every tier of the educational system. Whereas analysts in business use consumer data to target potential customers and personalise advertising, learning analytics leverages student data to build better pedagogies, target at-risk student populations, and assess whether programmes designed to improve retention have been effective and should be sustained — outcomes for legislators and administrators that have profound impact. For educators and researchers, learning analytics has been crucial to gaining insights about student interaction with online texts and courseware. However, ethical concerns are still prevalent in Ireland, which is slowing progression in this area. JISC has been instrumental in providing a code of practice for learning analytics, drawing from 88 publications to make recommendations to education institutions.

Relevance for Teaching, Learning, or Creative Inquiry

- If used effectively, learning analytics can help surface early signals that indicate a student is struggling, allowing teachers and schools to address issues quickly.
- The science behind learning analytics in online environments can be used to create adaptive software that caters to a student's individual learning curve in real time.
- When correctly applied and interpreted, learning analytics will enable teachers to more precisely identify students' learning needs and tailor instruction appropriately.

Learning Analytics in Practice

- JISC is developing projects to provide national level solutions to the challenges learning analytics poses in both higher and further education in the UK: go.nmc.org/effe.
- The Learning Analytics Community Exchange is convening the communities working in the educational data mining field, including university practitioners and researchers and those building first-generation commercial or open-source software: go.nmc.org/lacepr.
- The Open University produced a public written policy on ethical use of student data for learning analytics in hopes that the initiative will begin a debate in higher education about what level of data usage consent is required from students: go.nmc.org/ethi.

For Further Reading

Learning Analytics Don't Just Measure Students' Progress – They Can Shape It
go.nmc.org/learnan
> (Rebecca Ferguson, *The Guardian*, 26 March 2014.) This article describes how learning analytics can combine data analysis and visualisation to provide ways for learners to improve their performance while a course is in progress.

Lecturer Calls for Clarity in Use of Learning Analytics
go.nmc.org/clar
> (Chris Parr, *Times Higher Education*, 6 November 2014.) The Open University produced a publicly-accessible policy on the ethical use of student data for learning analytics and hopes the new policy will begin a debate in higher education.

Time-to-Adoption: Two to Three Years

Open Content

The movement toward open content reflects a growing shift in the way scholars in many parts of the world are conceptualising education to a view that is more about the process of learning than the information conveyed. Information is everywhere; the challenge is to make effective use of it. Open content uses open licensing schemes, like those of Creative Commons, to encourage not only the sharing of information, but the sharing of pedagogies and experiences as well. Part of the appeal of open content is that it is a response to both the rising costs of traditionally published resources and the lack of educational resources in some regions. As this open, customisable content — and insights about how to teach and learn with it — is increasingly made available for free over the Internet, people are learning not only the material, but also the skills related to finding, evaluating, interpreting, and repurposing the resources.

Relevance for Teaching, Learning, or Creative Inquiry

- In many cases, open materials can be easily updated and reposted to reflect the latest knowledge and discoveries.

- Many of the top universities, institutes of technology, and learning-focused organisations in Ireland are proponents and users of open content and have made materials available on demand to anyone.

- The use of open content promotes a set of skills for teachers that are critical in maintaining currency in any area of study — the ability to find, evaluate, and apply new information.

Open Content in Practice

- "Open Data Ireland," hosted by University College Cork, is an annual event for people who are passionate about sharing, learning, and using open data in Ireland: go.nmc.org/iedata.

- "Open Educational Resources of UCD Teaching and Learning," a wiki that hosts a number of OER and pedagogical frameworks for how to use them, was developed by University College Dublin: go.nmc.org/ucdoer.

- OpenupEd is a non-profit partnership from the EU that offers open courses, which has spawned the development of similar initiatives all over the globe: go.nmc.org/openuped.

For Further Reading

Open, but Undiscovered
go.nmc.org/undisc
> (Carl Straumsheim, *Inside Higher Ed*, 4 November 2014.) This survey of recent research describes a higher education environment in which academics and students are willing to use OER, but lack of awareness and information has stymied progress.

Open Education Resources Mythbusting Guide (PDF)
go.nmc.org/myth
> (Karolina Grodecka and Kamil Śliwowski, European Open Edu Policy Project, 2014.) This guide examines many of the criticisms and common misconceptions against the use of OER including the idea that OER cannot be produced professionally and that OER are too complex and scattered for instructors to use.

Putting a Dent in College Costs with Open-Source Textbooks
go.nmc.org/osource
> (Ann Carrns, *The New York Times*, 25 February 2015.) A report published by the Student Public Interest Research Groups analysed open-source pilot programmes at five colleges and found that students could save a significant amount of money per course if textbooks were replaced with free or low-cost open-source versions.

Time-to-Adoption: Four to Five Years

Adaptive Learning Technologies

Adaptive learning technologies refer to software and online platforms that adjust to individual students' needs as they learn. According to a paper commissioned by the Bill and Melinda Gates Foundation and authored by Education Growth Advisors, adaptive learning is a "sophisticated, data-driven, and in some cases, nonlinear approach to instruction and remediation, adjusting to a learner's interactions and demonstrated performance level, and subsequently anticipating what types of content and resources learners need at a specific point in time to make progress." In this sense, contemporary educational tools are now capable of learning the way people learn; enabled by machine learning technologies, they can adapt to each student's progress and adjust content in real time or provide customised exercises when they need it. In higher education, many academics envision these adaptive platforms as new, patient tutors that can provide personalised instruction on a large scale. There are two levels to adaptive learning technologies — the first platform reacts to individual user data and adapts instructional material accordingly, while the second leverages aggregated data across a large sample of users for insights into the design and adaptation of curricula.

Relevance for Teaching, Learning, or Creative Inquiry

- Adaptive learning dashboards are often viewable by students so they can gain a better understanding of what habits and activities are helping them learn more effectively.

- Adaptive learning technologies link specific concepts and skills from a course to how students are interacting with the material; a student, for example, may spend a disproportionate amount of time reading a single passage, signalling the algorithm to serve up more resources for them to better comprehend the concept.

- If applied effectively, adaptive learning can foster more personalised learning for students while providing institutions with key insights about the efficacy of their instruction.

Adaptive Learning Technologies in Practice

- The INTUITEL system, funded by education partners from the EU, monitors each learner's progress and behaviour, combines these data with pedagogical and methodological knowledge, and then deduces optimal guidance and feedback: go.nmc.org/intu.

- Irish company Fish Tree, now based in the US, is working with the National Institute for Digital Learning at Dublin City University to explore the potential of adaptive technologies: go.nmc.org/fish.

- A collaborative project between European universities known as GRAPPLE aims to build a platform that adapts to a learner's personal preferences, prior knowledge, skills and competencies, learning goals, and the personal or social context in which the learning takes place, accessible through any device: go.nmc.org/grapp.

For Further Reading

The Great Adaptive Learning Experiment
go.nmc.org/jwaters
 (John K. Waters, *Campus Technology*, 16 April 2014.) Conclusions gathered from early adopters of adaptive learning technologies have contributed to a growing body of research in support of adaptive learning.

Learning to Adapt
go.nmc.org/alpop
 (Paul Fain, *Inside Higher Ed*, 13 June 2014.) With many large institutions experimenting with adaptive learning, the author explores different conceptions of the term, from personalised learning to data-driven courseware.

Time-to-Adoption: Four to Five Years

Collaborative Environments

Collaborative environments are online spaces — often cloud-based — where the focus is on making it easy to collaborate and work in groups, no matter where the participants may be. As the typical educator's network of contacts has grown to include colleagues who might live and work across the country, or indeed anywhere on the globe, it has become common for people who are not physically located near each other to nonetheless collaborate on projects. Joint classroom-based projects with students at other schools or in other countries are becoming more common strategies used to expose learners to a variety of perspectives. The essential attribute of the technologies in this set is that they make it easy for people to share interests and ideas, to easily monitor their collective progress, and to see how ideas have evolved throughout the process. These tools are compelling and widely adopted because they are not only easy to use, but they are also either very low cost or free, and often accessible with a simple web browser.

Relevance for Teaching, Learning, or Creative Inquiry

- A class or project group can assemble a collaborative workspace very quickly using widgets that pull information from a range of sources.
- Collaborative environments are an efficient way for students to work together, whether the groups are composed of students in the same physical class or not.
- Large-scale collaborative environments can facilitate an almost spontaneous development of communities of people who share similar interests.

Collaborative Environments in Practice

- The Department of Online Delivery and the Nimbus Centre at Cork Institute of Technology developed "Red Ink Assessment Productivity Tool," an app that supports digital grading based on the social sharing of rubrics and comments: go.nmc.org/redink.
- The Digital Enterprise Research Institute at National University of Ireland, Galway developed the EA Training 2.0 project to provide a web-based, collaborative environment where students and employees from the private and public sector could learn about enterprise architecture: go.nmc.org/eatrain.
- Funded by the European Commission, INTENT (Integrating Telecollaborative Networks into Foreign Language Higher Education) recently convened foreign language instructors to discuss telecollaborative exchanges: go.nmc.org/intent.

For Further Reading

Collaboration through Flikr & Skype: Can Web 2.0 Technology Substitute the Traditional Design Studio in Higher Education?
go.nmc.org/studio
(Katja Fleischmann, *Contemporary Educational Technology*, 2014.) After conducting a five-week study, a researcher explores how defining characteristics of the studio-based environment — such as supporting interaction, active learning, and social engagement — are now taking place through Facebook, Flickr, and Skype.

Real-time Collaboration through Web Applications: An Introduction to the Toolkit for Web-based Interactive Collaborative Environments (TWICE)
go.nmc.org/twice
(Oliver Schmid et al., *Personal and Ubiquitous Computing*, June 2014.) With increasing access to mobile devices and large interactive displays in education environments, there are more opportunities for computer-supported collaborative work. This article describes how TWICE addresses the need for software toolkits that allow for device heterogeneity, resulting in true multi-user interaction and spontaneous emergence.

Time-to-Adoption: Four to Five Years

Digital Identity

Digital identity is the idea that everything interacting in the digital realm has or acquires a set of data or attributes, both inherent and changeable, that uniquely identify them as a person or entity online. Relevant to issues of privacy and authentication, digital identity encompasses a wide array of contextual and technical identifiers that exist in an ontological taxonomy. Traits can be understood and accepted in mutually agreed upon contexts such as when providing data like name and address for a PayPal transaction, and in the far more technical view that describes the relationships of these entities and objects to each other in cyberspace. At education institutions, students are generally provided a student identification upon enrolling, which stays with them for the duration of their studies. This has helped facilitate the creation and maintenance of student online portfolios that visually document learning progress over the years.

Relevance for Teaching, Learning, or Creative Inquiry

- The application of digital identity in the form of avatars or other discreet methods can encourage students to be more vocal in online learning environments as there is less of a risk of exposing themselves to their peers.

- Digital identity makes it easier for Irish higher education institutions to deliver accredited education to a worldwide audience. Mobility, interoperability between institutions, and transferability is critical to encouraging online students to enroll.

- The introduction of the concept of digital identity will help students realise the footprint they leave behind when logging in to different places on the web. This calls for safeguards to raise awareness of both the threats and opportunities afforded by students' management of multiple identities, and in doing so, promotes digital citizenship.

Digital Identity in Practice

- The EU now has a regulatory framework to ensure secure cross-border electronic interactions including electronic signatures, seals, and time stamps: go.nmc.org/trusteu.

- Researchers from the University of Twente in the Netherlands are working with InnoValor to develop multi-use mobile techniques for identity verification via app that incorporates biometric — namely face recognition — technologies: go.nmc.org/twente.

- Scientists from National University of Ireland, Galway's TOMI Lab are collaborating with Compact Imaging to develop applications of optical coherence tomography for identity verification: go.nmc.org/tomilab.

For Further Reading

Estonia Takes the Plunge
go.nmc.org/plunge
> (*The Economist*, 28 June 2014.) In an effort to streamline identification security, Estonia has begun issuing every person born in the country a digital birth certificate. Estonians aged 15 and over are issued electronic ID cards, which are used for health care, electronic banking, and voting, among other things. This sets an important precedent for digital identity management in higher education.

Peering Deep into the Future of Educational Credentialing
go.nmc.org/edcred
> (Doug Belshaw, *DML Central*, 30 March 2015.) Blockchain, the cryptographic technology that underpins Bitcoin, could skip the human element and automatically validate a person's identity for digital badging. The author describes other emerging technologies, such as Ethereum, as being potentially useful for credentialing.

Social Networks

Today's web users are prolific creators of content, and they upload photographs, audio, and video to cloud-based social networks such as Facebook, Pinterest, Twitter, YouTube, Flickr, and many others by the billions. While the initial emphasis of social networks was placed on producing and uploading media to these popular sharing sites, as the notion of social media has evolved it has ultimately become more about the conversations started and relationships formed via this media. According to digital agency EightyTwenty, Facebook and YouTube have the most subscribers in Ireland, and 23% of all social media users are college-aged. The country is also responsible for one million tweets per day. A recent survey by the Insight Centre for Data Analytics at NUI Galway highlighted the considerable role social media plays in the research and writing process for writing professionals, finding that 99% of Irish journalists use social media, with half of those using it daily to find news leads. For educational institutions, which have been slower to adopt social media in Ireland, it enables two-way dialogues between students, prospective students, educators, and the institution that are less formal than with other media. New tools, such as Facebook's social search engine, promise to mine these interactions using a concept known as the social graph. A person's social graph represents the sum of all of a person's online social connections (who he or she is friends with, who likes the things she or her friends are interested in, who among those connections is where, etc.) and provides a means to search and navigate those connections.

Relevance for Teaching, Learning, or Creative Inquiry

- Engagement in social networks either as producers of content, consumers, or aggregators of user-generated content allow academics to more deeply connect with each other.

- Social networks enable students to create powerful personal learning networks to direct and focus their own learning.

- Video platforms including YouTube and Vimeo enable educators to upload and share instructional videos that students can watch anywhere. Similarly, Google Hangouts allow them to connect with students outside of the classroom.

Social Networks in Practice

- Created by a UK student, the Student Room is a free social network that connects students across the globe with a forum for open discussions about exams, university applications, jobs, and more: go.nmc.org/sturoom.

- DISCUSS is a European platform to foster dialogue between the EU's Lifelong Learning Programme's participants by convening them in a social network: go.nmc.org/discus.

- Dublin-based Buz Media is launching a new social networking application called "Instigate" designed to bring people together in person by informing users of where members of their social network plan to be: go.nmc.org/insti.

For Further Reading

The Best Ways to Learn the Irish Language for Free
go.nmc.org/waysto
(Frances Mulraney, *Irish Central*, 23 April 2015.) Many language-learning apps leverage social networking. For example, SpeakTalkChat matches users with the same interests so they can practise their language skills in a natural manner.

One in Four Students Uses Social Media to Contact University Staff
go.nmc.org/contact
(Chris Parr, *Times Higher Education*, 26 February 2015.) A JISC survey found that more than a quarter of university students now use social media to contact their lecturers. Facebook is the most popular platform, followed by Twitter and What'sApp.

Methodology

The process used to research and create the *2015 NMC Technology Outlook for Higher Education in Ireland: A Horizon Project Regional Report* is very much rooted in the methods used throughout the NMC Horizon Project. All publications of the NMC Horizon Project are produced using a carefully constructed process that is informed by both primary and secondary research. Dozens of technologies, meaningful trends, and critical challenges are examined for possible inclusion in the report for each edition. Every report draws on the considerable expertise of a nationally renowned panel of experts that first considers a broad set of trends, challenges, and important developments in technology, and then examines each of them in progressively more detail, reducing the set until the final listing of trends, challenges, and important developments in educational technology is selected.

Much of the process takes place online, where it is captured and placed in the NMC Horizon Project wiki. This wiki, which has grown into a resource of hundreds of pages, is intended to be a completely transparent window onto the work of the project, and contains the entire record of the research for each of the various editions. The section of the wiki used for the *2015 NMC Technology Outlook for Higher Education in Ireland* can be found at ireland.wiki.nmc.org.

The procedures for selecting the topics that are in this report include a modified Delphi process now refined over years of producing the *NMC Horizon Report* series, and it began with the assembly of the expert panel. The panel as a whole was intended to represent a wide range of backgrounds and interests, yet with each member bringing a particularly relevant expertise. To date, hundreds of internationally recognised practitioners and thought leaders have participated in the NMC Horizon Project Expert Panel; in any given year, a third of expert panel members are new, ensuring a flow of fresh perspectives each year.

Once the expert panel for a particular edition is constituted, their work begins with a systematic review of the literature — press clippings, reports, essays, and other materials — that pertains to emerging technology. Panel members are provided with an extensive set of background materials when the project begins, and are then asked to comment on them, identify those that seem especially worthwhile, and add to the set. The group discusses existing applications of emerging technology and brainstorms new ones. A key criterion for the inclusion of a topic is the potential relevance of the topic to teaching, learning, or creative inquiry. A carefully selected set of RSS feeds from dozens of relevant publications ensures that background resources stay current as the project progresses. They are used to inform the thinking of the participants throughout the process.

Following the review of the literature, the expert panel engages in the central focus of the research — the research questions that are at the core of the NMC Horizon Project. These questions are designed to elicit a comprehensive listing of interesting technologies, challenges, and trends from the panel:

1. *Which of these important developments in technology will be most important to higher education in Ireland within the next five years?*

2. *What important developments in technology are missing from our list? Consider these related questions:*

    a. *What would you list among the established technologies that some Irish universities, institutes of technology, and educational programmes are using today that arguably ALL Irish universities and educational programmes should be using broadly to support or enhance teaching, learning, or creative inquiry?*

 b. *What developments in technology that have a solid user base in consumer, entertainment, or other industries should Irish universities, institutes of technology, and educational programmes be actively looking for ways to apply?*

 c. *What are the developments in technology you see advancing to the point that Irish universities, institutes of technology, and educational programmes should begin to take notice during the next four to five years?*

3. *What key trends do you expect to accelerate the uptake of emerging technology across higher education in Ireland?*

4. *What do you see as the significant challenges impeding emerging technology uptake across higher education in Ireland?*

One of the expert panel's most important tasks is to answer these questions as systematically and broadly as possible, so as to ensure that the range of relevant topics is considered. Once this work is done, a process that moves quickly over just a few days, the expert panel moves to a unique consensus-building process based on an iterative Delphi-based methodology.

The responses to the research questions are systematically ranked and placed into adoption horizons by each panel member using a multi-vote system that allows members to weight their selections. Each member is asked to also identify the timeframe during which they feel the technology would enter mainstream use — defined for the purpose of the project as about 20% of institutions adopting it within the period discussed. (This figure is based on the research of Geoffrey A. Moore and refers to the critical mass of adoptions needed for a technology to have a chance of entering broad use.) These rankings are compiled into a collective set of responses, and inevitably, the ones around which there is the most agreement are quickly apparent.

For additional detail on the project methodology or to review the interim products behind the report, please visit the project wiki, which can be found at ireland.wiki.nmc.org.

—————————— ‽ ——————————

2015 Horizon Project Ireland Expert Panel

Larry Johnson
Co-Principal Investigator
New Media Consortium

Mark Brown
Co-Principal Investigator
National Institute for Digital Learning,
Dublin City University

Paul Gormley
Co-Principal Investigator
Irish Learning Technology
Association
National University of Ireland, Galway

Samantha Adams Becker
Horizon Project Director/Lead Author
New Media Consortium

Michele Cummins
Research Manager
New Media Consortium

Alex Freeman
Researcher/Co-Author
New Media Consortium

Françoise Blin
Dublin City University

John Breslin
National University of Ireland, Galway

Ken Brown
Letterkenny IT

Catherine Bruen
Royal College of Surgeons
in Ireland

James Brunton
Dublin City University

Deirdre Butler
St. Patrick's College, Linked College of
Dublin City University

Leo Casey
National College of Ireland

Diane Cashman
University College Dublin

Fiona Concannon
National University of Ireland, Galway

Rosemary Cooper
IT Tallaght

Eamon Costello
Dublin City University

John Darcy
UK Open University - Belfast

Jim Devine
Consultant

Enda Donlon
Mater Dei Institute of Education, Linked
College of Dublin City University

Roisin Donnelly
Dublin Institute of Technology

Alison Egan
Marino Institute of Education

Tom Farrelly
IT Tralee

Margaret Farren
Dublin City University

Sharon Flynn
National University of Ireland, Galway

Seamus Fox
Dublin City University

Gerry Gallagher
Dundalk IT

Conor Galvin
University College Dublin

Mark Glynn
Dublin City University

Lizbeth Goodman
University College Dublin

Michael Halissey
H2 Learning

Tony Hall
National University of Ireland, Galway

Nuala Harding
Athlone IT

Gavin Henrick
Learning Technology Solutions

Catherine Kane
Trinity College Dublin

Teresa Logan-Phelan
Trinity College Dublin

Barbara McConalogue
Dublin City University

Nuala McGuinn
National University of Ireland, Galway

Larry McNutt
IT Blanchardstown and TU4Dublin

Daniel McSweeney
IT Blanchardstown

Trish Mountjoy
University College Dublin

Brian Mulligan
IT Sligo

Phelim Murnion
Galway-Mayo Institute of Technology

Brian Murphy
Ulster University

Rose Ní Dhubhda
National University of Ireland, Galway

Mairéad Nic Giolla Mhichíl
Dublin City University

Gearóid Ó Súilleabháin
Cork Institute of Technology

Tim O'Donovan
University College Cork

Muiris O'Grady
IADT

Muireann O'Keeffe
Dublin City University

Grace O'Leary
University College Cork

Lisa O'Regan
Maynooth University

Kevin O'Rourke
Dublin Institute of Technology

Tim Savage
Trinity College Dublin

Stephen Sloan
Momentum Northern Ireland

John Smith
St. Patrick's College, Linked
College of Dublin City University

Nuala Sweeney-Burt
Intuition

Bonnie Thompson Long
National University of Ireland, Galway

Anne Walsh
National University of Ireland, Galway

Adrienne Webb
Computers in Education Society of
Ireland

Laura Widger
Waterford Institute of Technology