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Hype Cycle for Education, 2014

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The digitalization of education is gaining momentum. An increasing number of choices face the CIO, and the "Hype Cycle for Education, 2014" offers a concrete example of a "CIO toolbox" of crucial tools for the next five years and beyond.

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Analysis

What You Need to Know

The digitalization of education is gaining momentum. In 2013, venture capital investments in education technology hit $1.25 billion. That was the second straight year with more than $1 billion invested in educational technology, and if the $559 million invested in the first quarter of 2014 is any indicator, education CIOs will have many more choices going forward.

Whatever eventually becomes of MOOCs (massive open online courses), they really have helped put digital education on the agenda. We witness intensified interest in community — even in senior management level cabinets — for such trends such as "student success" and "reinvention of credits." Educational leadership is increasingly engaged in discussions about rethinking educational business models and improving academic excellence to compete in a world of choice that has been driven by the death of distance and decreasing costs driven by consumerization and market competition. CIOs are grappling with an increasing choice of technologies that enable strategic capabilities that support those new business models.

To further complicate the picture, there is no "one-size-fits-all" set of technologies, and the CIO together with the institutional leadership must make well-informed choices that are a fit for several parameters such as institutional business model, geography and faculty readiness. Fortunately, there is a basic logic to digitalization of education. It first requires digitization of a lot of analog assets and capabilities and it can be done piece by piece, sometimes even tool by tool. This can, for example, be approached as a series of digital education moments that visualize the many

components that need to go from an analog state to digitized to enable new, fully digitalized ways of executing on the institution mission.

The "Hype Cycle for Education, 2014" offers a concrete example of a "CIO toolbox" of discrete tools for the next five to 10 years or so, giving many examples of the technology-related tools that Gartner believes are crucial for a CIO to track. But, more importantly, the Hype Cycle provides a methodology for building shortlist of interesting technologies to watch and help separate hype from reality in dialogue with institutional leadership, faculty, students and staff. We strongly recommend using the Hype Cycle toolkit (see Note 1) to produce customized Hype Cycles for the institution.

The Hype Cycle should be used together with the Market Clock to assess good timing for both investment in new technology assets and divestment in old. The yearly updated IT Market Clock for Higher Education is concrete selection of important assets in higher education, and we recommend it as a "seed" for creating a customized institution market clock (for example, see "IT Market Clock for Higher Education, 2013").However, the ultimate selection and timing must be driven by the institution strategy and business model. To help institutional leadership in general and CIOs in particular to achieve this, Gartner has published a set of notes that uses four business model scenarios to visualize and concretize future options for informing institutional strategy and evaluate their implications for IT investment priorities through Strategic Technology Maps (see "Visual Strategic Planning Using the Gartner Higher Education 'Business Model' Scenarios and Corresponding Strategic Technology Maps").

The Hype Cycle for Education, the Higher Education Market Clock, the Higher Education Business Model Scenarios and the Strategic Technology Maps are all tools that can be used separately, but we do see a strong synergy effect when all tools are used together. CIOs using all four tools have a way to improve their ability to communicate with the institution's leadership and stress the impact of technology early and throughout the strategic planning process.

The Hype Cycle

The 2014 Education Hype Cycle's core point of view is that of public K-12 and higher education institutions. However, with the expanding education ecosystem, there are an increasing number of players that impact the traditional way of executing the core common mission: to educate. We see an increase in the crossover of technologies, services and methodologies between the two levels of education, as well as integration/leverage of new education formats such as MOOCs for traditional as well as nontraditional learning. We see a surge of entrepreneurs entering the educational ecosystem who are not necessarily tied to the traditional K-12, higher education and further education categorizations. Innovators and venture capitalists are trying out many different business models that are aimed at K-12, higher education and the general consumer. We also see increasing application of corporate business strategies such as CRM and, not surprising, an influx of vendors from that space. We note the increasing need to define standards, such as grades and learning metadata, in the whole education ecosystem to enable the seamless mobility of students and their achievements. We also see an increasing need for higher education institutions to understand which skills and expectations the prospective students bring with them to their institutions, as well as what future employers expect of graduates entering the workforce.

In the 2014 Hype Cycle for Education, the digitalization trend continues with entries such as Mashware, alongside the steady progress of entries such as Adaptive Learning. The important trends of sourcing and standards that underpin delivery have evolved into a single trend — the "exostructure" — that emphasizes the increasing dependencies on external (consumerized) services and (automated) information exchange. The Hype Cycle entries Open Microcredentials and SIS International Data Interoperability Standards are good examples of the integration of IT infrastructure and education information exchange into a single inseparable "institution exostructure." This year we have put Exostructure Strategy on the Education Hype Cycle to track the institution's ability to leverage the education ecosystem and realize the vision of capabilities such as the Learning Stack. Notably, an increasing number of choices for sourcing, such as SaaS SIS, is making an exostructure strategy viable.

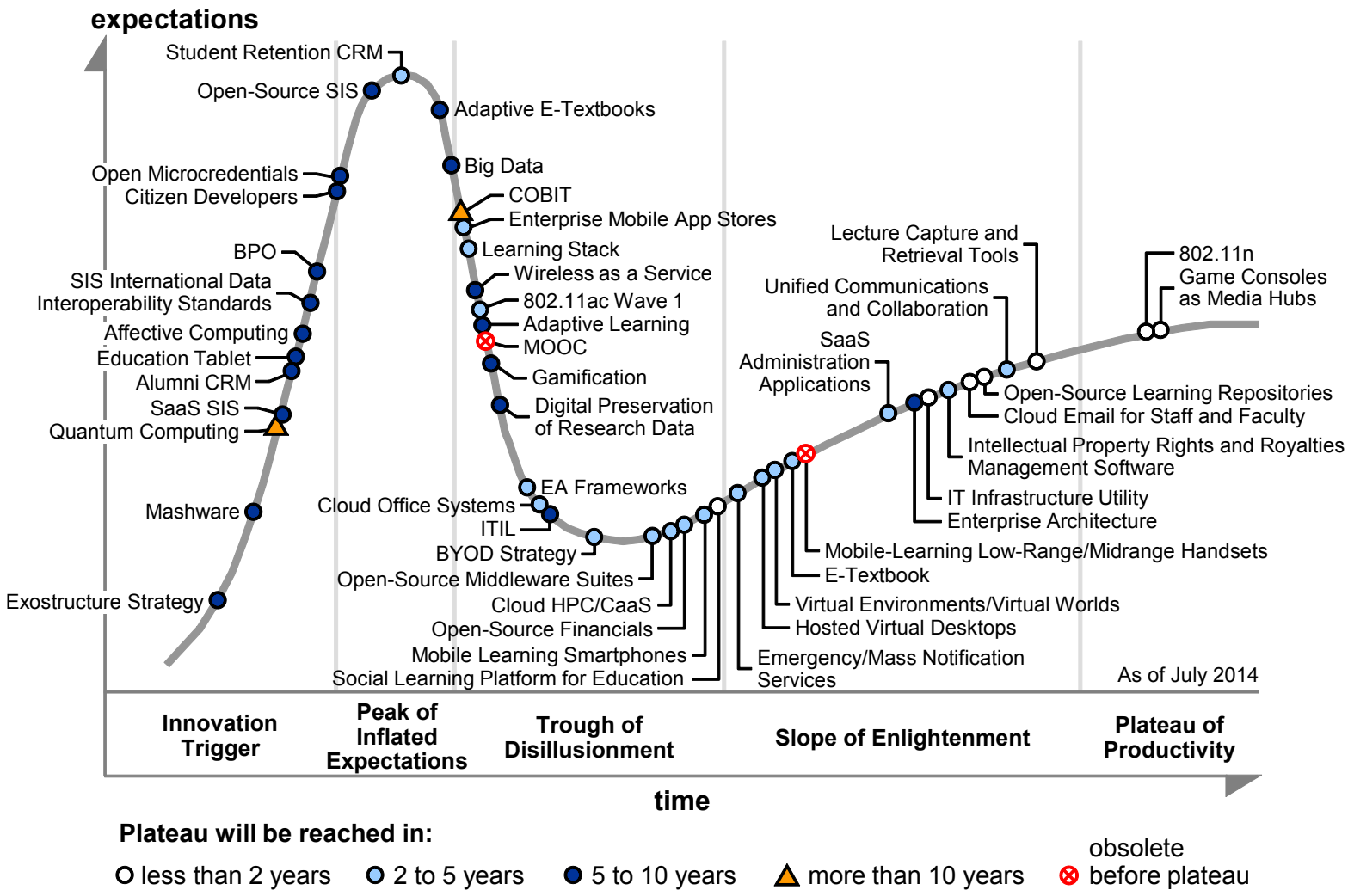
This complicates the picture for the education CIO even further, as all these truly digitalized capabilities are heavily intertwined with the core missions of the institution: to educate and (for several also) to research. These digitalized capabilities cannot be implemented without "the business side" driving the change, yet they often are enabled by a digitized and flexible exostructure.

Of the 49 technologies in the 2013 Hype Cycle, several key technologies have made progress, five have disappeared, and two have been interchanged. Campus App Store has been exchanged for Enterprise Application Stores. The momentum for the Campus App Store is very low and we believe that following the development of Enterprise Mobile Application Stores is more representative of the capabilities available to institutions to build, for example, a BYOD Strategy. Web-Based Office Productivity Suites has been replaced by Cloud Office Systems to better capture the hype and maturity profile of these productivity tools.

There are four new entries:

- Exostructure Strategy to track the institution's readiness to leverage the education ecosystem through such capabilities as adoption of industry-specific standards, openness to cloud providers and service delivery approach
- SaaS SIS that offers a vector for delivery of next-generation student systems, natively mobile and social, and capable of supporting data-driven decision making
- Alumni CRM to track an emerging type of CRM solutions that extend beyond fundraising and aims at building a lifelong relationship with the alumni
- 802.11ac Wave 1 to illustrate the continued pressure on CIOs to deliver more wireless bandwidth, and the need for new standards to cope with the density of coverage that this implies.

Figure 1. Hype Cycle for Education, 2014



Source: Gartner (July 2014)

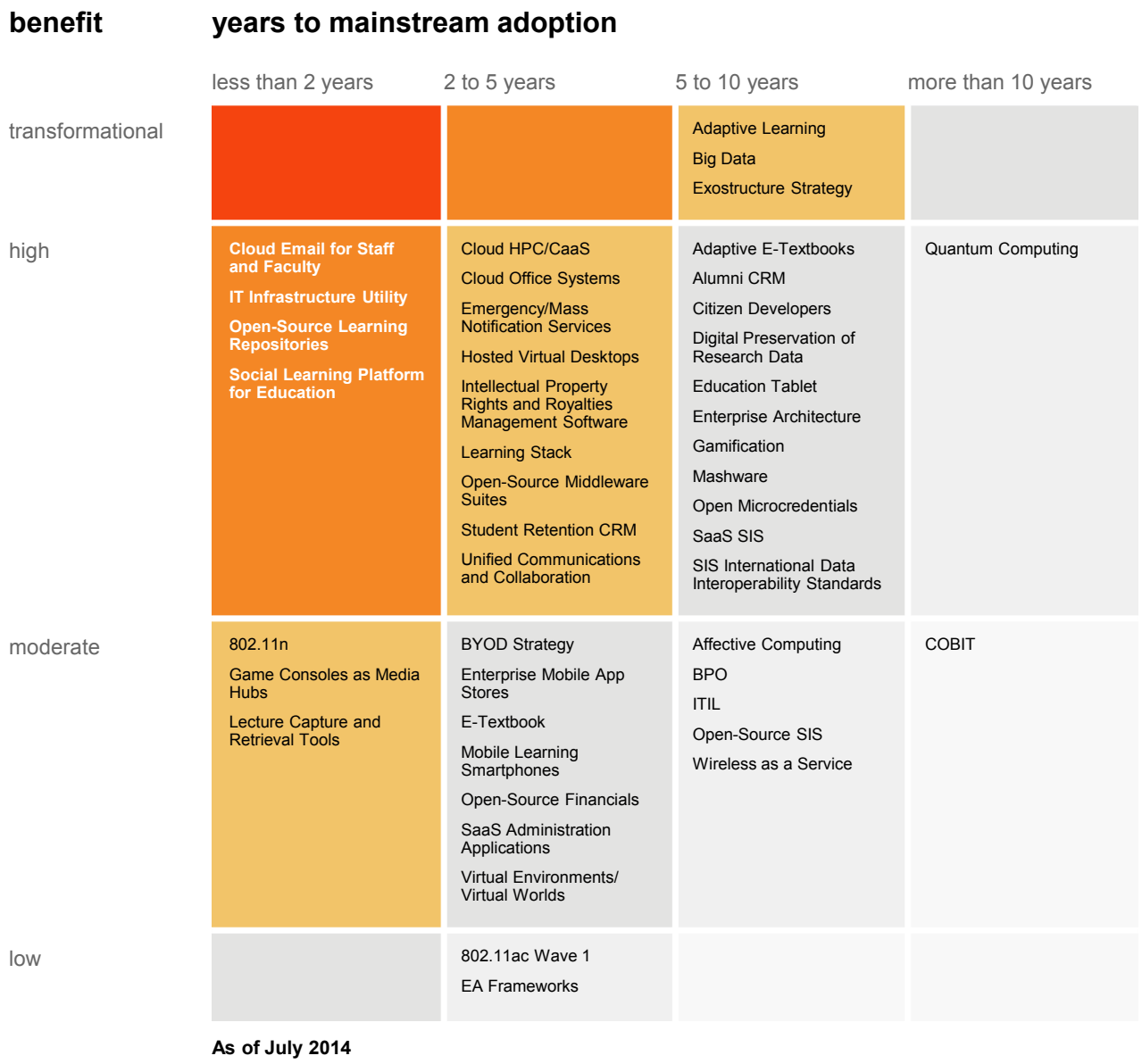
The Priority Matrix

The Priority Matrix for the Hype Cycle for Education is more nuanced and context-dependent than those of most nonindustry Hype Cycles. The reason is that benefit ratings can vary substantially depending on the various types of institutions. Furthermore, we intentionally use some general Hype Cycle entries taken directly from topical Hype Cycles, such as the "Hype Cycle for Enterprise Architecture, 2014," to relate to their overall standing in maturity and adoption, even outside the education community. The specific institutional context and the general hype/maturity aspect are very important in the assessment of when these technologies are "ubiquitous" enough to build new services or curricula on top of them. This means that the benefit rating in this document is not normalized to any specific type of institution and, more importantly, some technologies have benefit ratings that are relative to their niche technology category. The result can be seen in benefit ratings, such as high for Cloud Email for Staff and Faculty, while the rating for the E-Textbook entry is only moderate. In the first case, the rating is due to the relative benefit to an internally managed mail solution. In the second case, the rating is relative to the original expectations for e-textbooks, the competing alternative Adaptive E-Textbooks and their importance to the core mission of education.

In this context, MOOC, Adaptive Learning and Big Data are all rated transformational for their ability to bring education in a new form to new learners and collect vast amounts of data that can help improve the education ecosystem.

To help clients determine which key investments in IT will be most strategic in positioning their institutions for long-term success, we have developed a complementary tool to the Hype Cycle called the Strategic Technology Map (see "Strategic Direction and Timing in Education: Mashing Up the Strategic Technology Map and the Hype Cycle" and "Toolkit: Speed Up Your Innovation Process; How to Quickly Create Interactive Strategic Technology Prioritization Maps From the Education Hype Cycles"). The Strategic Technology Map makes it clear that achieving success is seldom about individual technologies or even singular chains of dependencies; it is really about an ecosystem of technologies that must be mature enough to support the institution's strategy. The Strategic Technology Map can help identify the strategic parts of the ecosystem and its interdependencies, while the Hype Cycle provides crucial information about the weakest link in the ecosystem, leading to better analysis of the timing of the "tipping point." If these tools are also combined with business model scenario planning (see "Visual Strategic Planning Using the Gartner Higher Education 'Business Model' Scenarios and Corresponding Strategic Technology Maps"), a sustainable, uniquely adapted and agile technology strategy can be devised for each institution.

Figure 2. Priority Matrix for Education, 2014



Source: (Gartner 2014)

Off The Hype Cycle

Five technologies have been removed from the Hype Cycle for Education, 2013:

- Two technologies — Tablets and E-Book Readers — are off the Hype Cycle since they are consumer technologies that are well into the Plateau of Productivity, both in general market penetration and in maturity, even if their uptake in the education ecosystem is not yet sufficient to allow general changes in curriculum in most institutions.

- Mashups is off the Hype Cycle since it is a concept that is well into the Plateau of Productivity and used in many educational settings.
- Self-Publishing is off the Hype Cycle since it is a concept that is well into the Plateau of Productivity, with several commercial and open source options for faculty.
- Social Software Standards is off the Hype Cycle since it has not fulfilled its promise in a global context and the current trend seem to be walled gardens of social software platforms dominated by large providers that are largely separated by culture or language barriers. However, select national research and educational networks such as SURF still pursue this important capability for the research community through services such as SURFconext.

On the Rise

Exostructure Strategy

Analysis By: Jan-Martin Lowendahl

Definition: Exostructure strategy refers to acquiring the critical capability of interoperability to leverage the increasing numbers of partnerships, tools and services in the education ecosystem. An exostructure strategy is not an opportunistic approach but, rather, a thought-out, defined strategy.

Position and Adoption Speed Justification: The exostructure concept is about building an "exoskeleton" of services that support the education institution from the outside rather than from the inside. The building blocks are standards such as eduPerson and Metadata for Learning Opportunities (MLO) that allow a freer flow of information among education ecosystem players. When done right, the exostructure approach enables institutions to leverage industry (and other) best-practice services from the cloud, rather than having to bring them inside the campus walls. The exostructure approach enables a much more flexible and agile IT services approach that can allow the institution to adapt to the seemingly inevitable disruption of the education ecosystem. In a competitive world, the winner in the long run is not the strongest but the most adaptable.

The need for an exostructure strategy is not really new and has grown out of decades of object-oriented thinking, such as service-oriented architecture (SOA) and Web services. However, exostructure — together with infrastructure, suprastructure and endostructure — outlines four levels of interoperability that enables CIOs to articulate an interoperability strategy in a new more compelling way that can be brought into the boardroom as a future critical capability for the institution.

The key enablers of exostructure strategy in education are standards such as Open Badges, Learning Tools Interoperability (LTI), Caliper Learning Analytics Interoperability Framework, Question and Test Interoperability (QTI), Accessible Portable Item Protocol (APIP), eduPerson, Metadata for Learning Opportunities (MLO) and Postsecondary Electronic Standards Council (PESC) transcripts. Recent years have seen an increase in interest in these types of standards and organizations, such as PESC and IMS Global Learning Consortium, respectively. Many vendors now understand that these standards are good for their customers and that interoperability increases their potential

market. For example, all major learning management system (LMS) providers now support LTI, and several vendors are interested in the work around the Caliper Learning Analytics Interoperability Framework, which promotes the idea of personalized learning. Furthermore, the education community facilitates the uptake of exostructure services through trusted brokers, such as InCommon and the Internet2 Net+ Initiative.

This exostructure strategy profile is Gartner's attempt to track the institutions' ability to interoperate in, and to leverage, the education ecosystem. It is not about following a specific technology standard or vendor offering — although the two are prerequisites for the successful execution of an exostructure strategy.

As a concept, exostructure strategy is rather new in the education ecosystem, but this strategy has emerged because of the Internet in general and cloud in particular. Altogether, exostructure strategy appears in the Technology Trigger phase, with a five- to 10-year trajectory to the Plateau of Productivity.

User Advice: Exostructure strategy is about achieving a substantially higher level of interoperability, which is necessary to leverage the full potential of the education ecosystem. It is about creating an institutional "interoperability first" mindset through a new language that enables the education CIO to tell a compelling story that drives change.

The education CIO should execute the exostructure strategy through identifier, format and protocol (IFaP) portfolios of standards, but they should beware of vendors with a strategy of proprietary or "walled garden" standards.

Education CIOs and institution leadership should use an exostructure strategy to focus on leveraging "each other's strengths" in the education ecosystem and begin with using trusted cloud brokers.

Internally, education CIOs can prepare by focusing on the capability to change through defining services, and they should use service portfolios and service catalog tools for exostructure agility.

Business Impact: The future belongs to exostructure rather than infrastructure.

Digitization of analog processes and assets is feeding the expansion of the education ecosystem, increasing competition, while digitalization is changing the nature of the competition, as outlined in "The Gartner Higher Education Business Model Scenarios: Digitalization Drives Disruptive Innovation and Changes the Balance." While this networked world represents new threats, it also creates new opportunities. The same forces that put competition practically on campus, such as the Internet "death of distance," are also the key to increased competitiveness. The key to success is a new, substantially higher level of interoperability.

The power of the whole education ecosystem comes from interoperability — not isolation. Education institutions should compete on the basis of academic excellence, rather than common commodity. Playing the non-zero-sum win-win game is a necessity to make the education ecosystem meet the increasing need for the cost-effective, scalable education demanded by society.

Interoperability fundamentally means an ability to leverage other education ecosystem players' strengths, while the institution focuses on its competitive differentiators. The key institutional capability is change, and the concrete strategy is to build in an exostructure rather than on an infrastructure.

Several new companies, such as Knewton, Civitas Learning, Intellify Learning and Carney Labs, are building new services that depend on the exostructure.

The foundational question today for all players in the education ecosystem (institutions and vendors alike) is:

- How well can you integrate yourself in the ecosystem that matters to your student, customer or partner? The quality of your exostructure is the answer.

Benefit Rating: Transformational

Market Penetration: Less than 1% of target audience

Maturity: Embryonic

Recommended Reading: "Gaining Competitive Advantage in the Education Ecosystem Requires Going Beyond Mere Infrastructure to Exostructure"

"The Gartner Higher Education Business Model Scenarios: Digitalization Drives Disruptive Innovation and Changes the Balance"

Mashware

Analysis By: Jan-Martin Lowendahl; Allen Weiner

Definition: Mashware represents the intersection of mashups and courseware. A mashup represents the ability to mix together various content assets from different media and disciplines to create a new asset. The courseware part is the multichannel delivery of "MashBooks," which are the result of mixing together various educational assets (book chapters, video, audio, charts and so forth) into material used for instructional purposes.

Position and Adoption Speed Justification: Mashware allows educators great freedom to create custom content for students by allowing them to "mash together" opens assets and licensed content, along with education-oriented tools such as assessments and quizzes. Mashware, which results in MashBooks, is in its infancy, and faces issues such as a lack of vendors and the need for educators to be adept at using new publishing tools.

Mashware remains an engaging concept, but remains primarily an ad hoc solution with a number of new players in the market, mostly composed of small startups that lack connections with major educational publishers and middlemen who have access to educational content rights. Among those new players are Coggno (allows the creation of MashBooks sold via its marketplace), Mindflash (also with a market for selling MashBooks) and Pathwright. Of greater interest, major publishers continue to see value in mashware, yet view it as a future business opportunity versus as

an immediate need, and mostly are in the experimental stage. Pearson continues to gain traction with Blue Sky, which is a textbook example of a mashware platform, in that it facilitates the creation of MashBooks that contain Pearson content, open educational resource OER materials as well as works created by instructors. Other publishers with mashware platforms include McGraw-Hill (Create) and Houghton Mifflin Harcourt (whose platform does not carry a special brand other than "custom solutions").

User Advice: CIOs tasked with the responsibility of maintaining the mashware platform:

- Select one that is easy to use, yet produces compelling content.
- Understand that a digital alternative to textbooks should not be solely for cost savings, but rather for the goal of better student outcomes.
- Educational institutions should enforce a policy that recommends students use devices that support open content to allow access to the range of mashware-created e-textbooks and related materials.

Business Impact: Mashware's future is guided by two distinct attributes that must meet to be successful:

- The platform to create mashware must be easy to use so that educators can be quickly trained on creating new content.
- The resulting MashBooks must be compelling enough for students to remain engaged.

At this point, no platform satisfies both values, but leading providers are headed in that direction.

Mashware and resulting MashBooks become more valuable to educators as they become more adaptive. Companies such as Denmark-based Area9 (working with McGraw-Hill) are developing platforms that allow publishers and developers to build more adaptive functionality into their e-textbooks. The ability to incorporate adaptive learning elements into mashware platforms — which can be accomplished using advanced content tagging techniques — will propel mashware to become an even more vital part of an educator's teaching toolkit.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Embryonic

Sample Vendors: McGraw-Hill; Pearson; SharedBook; Trunity

Recommended Reading: "The Emergence of 'Mashware' Points to a New Digital Resource for Educators"

"Adaptive Learning Looms as an E-Textbook Game Changer"

Quantum Computing

Analysis By: Jim Tully

Definition: Quantum computers use quantum mechanical states for computation. Data is held in quantum bits (qubits), which have the ability to hold all possible states simultaneously. This property, known as "superposition," gives quantum computers the ability to operate exponentially faster than conventional computers as word length is increased. The data held in qubits is influenced by data held in other qubits, even when physically separated. This effect is known as "entanglement." Achieving both superposition and entanglement is extremely challenging.

Position and Adoption Speed Justification: A large number of technologies are being researched to facilitate quantum computing. These include:

- Lasers
- Superconductivity
- Nuclear magnetic resonance (NMR)
- Quantum dots
- Trapped ions

No particular technology has found favor among a majority of researchers, supporting our position that the topic remains in the relatively early research stage.

Hardware based on these technologies is unconventional, complex and leading-edge, yet most researchers agree that hardware is not the core problem. Effective quantum computing will require the development of algorithms (quantum algorithms) that will solve real-world problems while operating in the quantum state. The lack of these algorithms is a significant problem — although a few have been developed. The output is typically in the form of a probability distribution, requiring multiple runs to achieve a more accurate result.

One example is Grover's algorithm, designed for searching an unsorted database. Another is Shor's algorithm, for integer factorization. Many of the research efforts in quantum computing use one of these algorithms to demonstrate the effectiveness of their solution.

The first execution of Shor's algorithm was carried out in 2001 by IBM and Stanford University. Since then, the focus has been on increasing the number of qubits available for computation. The latest published achievement is a factorization of the number 21 at the University of Bristol in 2012. The technique used in that case was to reuse and recycle qubits during the computation process in order to minimize the required number of qubits. The practical applications indicated by these examples are clearly very limited in scope, and we expect this situation to continue through the next 10 years or more.

D-Wave Systems has demonstrated various configurations of quantum computers, based on supercooled chips. These systems focus on the use of quantum techniques for a range of optimization applications. The technique finds the mathematical minimum in a dataset very quickly.

Lockheed Martin, NASA and Google are making use of D-Wave's products and services for, among other things, research on machine learning.

To date, D-Wave's demonstrations have involved superposition but have not demonstrated entanglement in any significant way. Without quantum entanglement, D-Wave computers cannot attack the major algorithms demonstrated by the smaller quantum computers that do achieve entanglement.

Most of the research we observe in quantum computers relates to specialized and dedicated applications. Given the focus and achievements of research in quantum computing, Gartner's view is that general-purpose quantum computers will never be realized; they will instead be dedicated to a narrow class of use. This suggests architectures where traditional computers offload specific calculations to dedicated quantum acceleration engines. A lack of programing tools such as compilers is another factor that is restricting the broader potential of the technology. Specific applications include optimization, code breaking, image analysis and encryption.

The technology continues to attract significant funding, and a great deal of research is being carried out. However, we have not seen any significant progress on the topic over the past year, although publicity and hype have increased a little.

User Advice: If a quantum computer offering appears, check its usefulness across the range of applications that you require. It will probably be dedicated to a specific application, and this may be too narrow to justify a purchase. Check if access is offered as a service. D-Wave has now moved in this direction, and it may be sufficient at least for occasional computing requirements. Some user organizations may require internal computing resources, for security or other reasons. In these cases, use of the computer on a service basis — at least initially — would offer a good foundation on which to evaluate its capabilities.

Business Impact: Quantum computing could have a huge effect, especially in areas such as optimization, code breaking, DNA and other forms of molecular modeling, large database access, encryption, stress analysis for mechanical systems, pattern matching, image analysis and (possibly) weather forecasting. "Big data" analytics is likely to be a primary driver over the next several years.

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Embryonic

Sample Vendors: D-Wave Systems; Delft University of Technology; IBM; Stanford University; University of Bristol; University of Michigan; University of Southern California; Yale University

SaaS SIS

Analysis By: Terri-Lynn B. Thayer

Definition: Software as a service (SaaS) for student information systems (SISs) in education is software that is owned, delivered and managed remotely by one or more providers, based on a

single set of common code and consumed in a one-to-many model by all contracted customers at any time, on a pay-for-use basis or as a subscription.

Position and Adoption Speed Justification: SISs are the heart of institutional ERP suites, providing both back-office administrator and student/faculty-facing functionality to manage key institutional information assets, such as student courses taken, grades and transcripts. SIS solutions delivered as SaaS applications have been available for some time, but primarily for very small or "for profit" institutions; however, recently, several vendors have initiated development of comprehensive SaaS SIS solutions.

SaaS is still a relatively new delivery model for the education market. Only recently have mainstream institutions started to work with SaaS vendors, such as Workday, to implement SaaS applications for HR and finance in higher education. As the number of institutions with successful deployments and advancing implementation projects for HR and finance has grown, so has the interest in the availability of an equivalent option for SaaS-based SIS. SIS implementations have notoriously been difficult, as this is where institutions have their most proprietary business practices. The SIS is also one of the most visible systems to the key constituencies of faculty and students.

For these reasons, a number of institutions still run aged homegrown SIS solutions. However, most student systems deployed today, whether vended or homegrown, have their foundations in decades-old architecture. Necessary Web, mobile and social functionality has been provided by a series of layered-on solutions from ERP vendors that incorporated a growing array of acquired technologies as part of their suite solutions or from third-party vendors that have formed partnerships with ERP vendors.

Many academic institutions with on-premises ERP-based SIS modules are finding themselves increasingly weighed down and constricted by the demands of maintaining these solutions. Those now facing investments for major upgrades or contract renewals are assessing whether a SaaS model can offer a total cost of ownership (TCO) that is lower than their current solutions and/or provide for more predictable and even spending, while affording more agility and innovation. These same users are also becoming tired of waiting years for vendor upgrades to deploy the types of functional enhancements demanded by students and faculty, who are accustomed to the rapid innovation in cloud consumer services, such as Google. Although ERP vendors have introduced methods to provide new functionality faster, adoption on campuses has at times been slow — often as a result of faculty and administration aversion to change and the dependence in many cases on large capital projects to achieve results. This is all driving interest in the SaaS model, which typically requires adoption of standard business practices (implement by configuration, not customization, of the software) but in return provides new capabilities more frequently, at least several times per year. Finally, SaaS vendors offer improved user experience based on a more modern Web 2.0 architecture and technology, as well as native mobile, social and CRM functionalities, which gives them an edge over traditional providers in the minds of many SIS users.

SaaS SISs have been successfully adopted in a small number of institutions in the general education sector and for point solutions, such as financial aid, in a broader set of institutions. Recent announcements and development by major vendors provide a much anticipated SaaS option for large, complex and global institutions. While these offering are still in the embryonic stage

as vendors work with key partner institutions to design and build them, we expect the benefit for implementing this technology will be high, given the potential for dramatically improving the user experience and thereby promoting student engagement and faculty productivity. Individual components are expected to begin becoming generally available in late 2014 or early 2015, at which point we expect the speed of adoption to accelerate.

User Advice: Consider the SaaS model for SIS if you have:

- Limited IT resources
- A limited capital budget but sufficient operational budget
- The need for faster delivery of new functionality
- The desire to move away from customizing to configuring your business applications
- The need for lower-impact upgrades
- Opportunity presented by legacy contract expiration or significant looming upgrades

Because SaaS SIS solutions are usually based on a subscription licensing model, they can be purchased through an operating expense budget, rather than as capital expenditures. Thus, the upfront cost is less for a SaaS solution, but the ongoing TCO may not be. Although cost is only one consideration, perform a cost analysis (especially if the vendor offers choices) to determine which model is best. While new cloud models have improved architectures to support configuration, the commitment to a customization-free implementation will require strong leadership and governance structures to achieve success. Ensure academic leaders are willing and able to sponsor the initiative and specifically lead the charge for the inevitable change of faculty practices and process.

Business Impact: SaaS SISs have the potential for high business impact. Their modern design clearly can bolster operational efficiencies and effectiveness, while improved user interfaces will surely increase student and faculty engagement. However, the most important impact is likely to be the support of new business models essential for the modern academy — support for nontraditional students, competency-based curriculum and financial aid are a few examples of ways in which these solutions may support institutional change that directly results in increased revenue and an improved competitive position.

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Embryonic

Sample Vendors: Amperea Software; Oracle; TopSchool; Workday

Recommended Reading: "CIOs Should Clarify Roles and Responsibilities of IT for Cloud Applications in Higher Education"

"Trends in SIS and LMS Solutions for K-12 Education"

"Best Practices for Supporting ERP/Business Applications in the Cloud"

Alumni CRM

Analysis By: Terri-Lynn B. Thayer

Definition: Alumni CRM is defined as systems that are used by higher education institutions to engage and serve alumni. The functionality often includes alumni directories, alumni networking, alumni contact management and event management. This functionality may be part of an institutionwide CRM solution, an alumni development fundraising system, an ERP suite or a stand-alone product.

Position and Adoption Speed Justification: Alumni development systems have been in place on many campuses for years with the primary purpose to support fundraising and a secondary role to support alumni relations. These largely back-office systems supported functions such as campaign management and gift accounting. Alumni engagement and networking activities were supported in a variety of often disparate systems, including printed alumni directories, alumni portals, event management systems, email and Excel. However, emerging requirements for sophisticated communications functionality that leverages social media, mobile technologies, digital marketing, online fundraising and analytics are being driven both by the institutions' desire to reap additional value from the alumni community as well as appeal to alumni's perceived value of a sustained connection to the institution and broader alumni network.

Vendors in the student enrollment CRM and student retention CRM space are now leveraging their foundational platforms and CRM expertise to provide alumni CRM product offerings to meet these needs. These products are positioned to support the much-hyped vision of a 360-degree view of a student. Additionally, niche vendors are emerging with alumni CRM point solutions. Campus stakeholders are not limited to the alumni office but also include career services, athletics, events management and continuing education — all that have something to gain from having data about and access to the alumni community. In fact, on many campuses, the fundraising organization typically reports satisfaction with the legacy alumni development system, while it is this broader set of stakeholders that is most often driving the interest in alumni CRM. Most solutions in this space rely on a cloud delivery model and offer extensive social networking integration. The technology is still emerging today but is rapidly evolving, and as it does, interest and adoption are growing. Alumni CRM is positioned halfway up the Peak of Inflated Expectations curve, and product maturity, integration success, analytics support and alumni community interest will be key to the pace of movement along the Hype Cycle.

User Advice: Classic alumni development systems are mature tools to record alumni demographics and donations but may not be adequate to meet emerging CRM needs. Institutions should consider all aspects of the student experience and develop a CRM strategy that has a cradle-to-grave perspective relative to the student life cycle. Institutions can no longer afford to have their alumni data isolated in systems that are solely focused on fundraising campaign support. Universities that adopt an institutionwide CRM strategy with integrated technologies will be best-positioned to leverage the long-term value of their alumni. CIOs should review their legacy vendor road maps and consider upgrade (as well as replacement) options and/or augmentation with new alumni CRM

solutions. This advice is particularly important for those institutions whose business model is highly dependent on the value proposition of the exclusive alumni network, namely private institutions with high brand equity (see "Introducing Visual Strategic Planning Using Four Higher Education 'Business Model' Scenarios and Strategic Technology Maps").

Business Impact: Alumni CRM technology offers the promise of enhancing alumni engagement, and in doing so, increasing both the degree value to the alumni and increased customer lifetime value for the institution. Interest in lifelong learning and the "death of distance" are creating opportunities for institutions to utilize this data to grow institutional revenue at a time when the pressures on other traditional revenue sources are acute.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: 360Alumni; Blackbaud; Campus Management; Ellucian; Graduway; iModules Software; Symplicity; TargetX

Recommended Reading: "The Coming of Age for CRM in Higher Education"

"Predictions for the Higher Education 'Business Model' Landscape in 2025 and Beyond Will Help CIOs Plan Now"

"Higher Education 'Business Model' Scenarios and Corresponding Strategic Technology Map — Only Us U Focuses on Brilliance for the Market"

"Higher Education 'Business Model' Scenarios and Corresponding Strategic Technology Map — Me, Not U Looks to Edge in the Market"

Education Tablet

Analysis By: Jan-Martin Lowendahl; Bill Rust

Definition: An education tablet is either a purpose-built media tablet that comes preloaded with educational content and applications, or it's customized by the hardware provider of an educational institution for use in educational settings.

Position and Adoption Speed Justification: There are two components to an education tablet: hardware and software. In some cases, as in the new Amplify or LearnPad, the hardware comes preloaded with selected software customized for the device's operating system (in the case of Amplify, a custom flavor of Android). It also has the ability for educators to then customize the content to their particular purpose. Amplify, for example, will act as a clearinghouse for applications and content that can be used on its tablet. That said, these devices are moving more slowly along the Hype Cycle as hardware manufacturers such as Apple and Samsung increase efforts to build a tighter connection between their devices and content — and in the case of Samsung, connection to learning management systems (LMSs). In addition, Intel, fresh off its acquisition of content provider

Kno, has moved beyond its initial educational product suite to offer an educational tablet. Intel's device — aimed at the global education market and targeting the ministries and departments of education as the primary buyer — comes preloaded with Kno textbooks and a suite of productivity apps that enable students to better use such features as note taking and videoconferencing.

Another key player is Google, which has added emphasis to its Google for Education program — taking direct aim at Apple. Google, which offers its Android-based set of solutions via its Play Store, also provides a suite of tools for teachers and students that is optimized for Chromebooks.

Yet another model that uses Windows OEMs, such as Dell and Samsung, is primarily hardware-focused, with each vendor offering a basic framework for K-12 and higher education, driven by vertical efforts within its company. In the case of Google, the company highlights its YouTube, Maps and Google+ services, and illustrates how they can be used in educational settings. By and large, these hardware providers do not offer much in the way of e-textbooks or related content.

Apple remains a wild card in the educational device space. While the company provides a wide range of content, apps and solutions for its laptops, iPads and iPhones, industry observers believe that the next release of Apple tablets will include a larger device aimed squarely at the educational market. Apple, with a history of working in the educational space, is geared to be a major disrupter in both content as well as LMSs. Apple believes its iTunes U could morph into a system that facilitates connections between teachers and students, teachers and content providers, and even teachers and administrators and parents.

User Advice: For practical purposes, CIOs must deal with hardware and software separately. Hardware issues such as compatibility with existing infrastructure, governance and cost are top priorities at the moment, and technology leaders are far from the point of making decisions about devices that united hardware and software in one neat package. Managing a new set of devices will be a major issue for already overworked CIOs.

Software is a different issue, given that it is driven in bottom-up fashion. Educators and students are making content decisions outside the office of the CIO, even further complicating decisions over educational devices, For unified hardware-software strategies to see daylight, CIOs must demand a seat at the decision-making table when it comes to issues related to content.

Business Impact: The past year, with new major players entering the space in offering either preloaded devices or devices optimized for education, IT leaders need to face the future and prepare their technology ecosystems to take advantage of a new generation of educational devices. The impact has far-reaching consequences in that higher educational institutions will need to provide content ecosystems (governed closely by IT leaders) to remain competitive as well as use this new connection between students and learning as a possible differentiator.

For K-12, the challenge is greater. With school districts around the globe placing an emphasis on one-to-one learning and offering tools that allow students to learn at their own pace (adaptive learning), big decisions will need to be made. Hardware providers will be exerting pressure on administrators and those with political and/or financial power to select their devices as the standard bearer for their schools. We are likely to see a number of missteps made in K-12 as decisions are

made less on the basis of product and solution and more on a hardware or software provider's ability to effectively lobby key decision makers.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Amplify; Apple; Dell; Google; Microsoft; Samsung

Recommended Reading: "Adaptive Learning Looms as an E-Textbook Game Changer"

"Predicts 2014: Technology Drives Education Toward Transformation"

"Higher Education 'Business Model' Scenarios and Corresponding Strategic Technology Map — Me, Not U Looks to Edge in the Market"

Affective Computing

Analysis By: Jan-Martin Lowendahl

Definition: Affective computing technologies sense the emotional state of a user (via sensors, microphone, cameras and/or software logic) and respond by performing specific, predefined product/service features, such as changing a quiz or recommending a set of videos to fit the mood of the learner. Affective computing tries to address one of the major drawbacks of online learning versus classroom learning — the teacher's capability to immediately adapt the pedagogical situation to the emotional state of the student in the classroom.

Position and Adoption Speed Justification: True affective computing technology, with multiple sensor input, is still mainly at the proof-of-concept stage in education, but it is gaining more interest as online learning expands and seeks means to scale with retained or increased quality. A major hindrance in its uptake is the lack of consumerization of the needed hardware and software involved. It has to be inexpensively available for students because they use their personal devices before education institutions can deploy affective computing software. However, products such as Affectiva's Affdex or ThirdSight's EmoVision are promising because they enable relatively low-cost, packaged access to affective computing functionality, even if these particular products are geared toward testing media/advertising impact on consumers. Another industry, the automotive industry, is more advanced. Here, the technology has not yet found its way into mainstream vehicle production, but lightweight emotion detection — for example, being tired behind the wheel — is an option in trucks on the market today. Addressing issues such as driver distraction and driving while tired creates more awareness for mood sensing in a practical and ubiquitous product — the car.

The leading research lab in this field is MIT's Affective Computing Research Group, which has many projects and is working on sensors, such as wristband electrodermal activity sensors connected by Bluetooth to a smartphone, and software, such as the MIT Mood Meter, that assess the mood on campus based on frequency of smiles as captured by ordinary webcams. Developments like these can speed up the application of affective computing in education, but the road ahead still seems

long due to complexity. It is possible that there needs to be a breakthrough in a more consumer-oriented area such as gaming before affective computing can be applied at a larger scale. One thing that might jump-start implementation would be if facial recognition services for identification and proctoring in online learning, from companies such as Smowl and KeyLemon, were implemented more often and if affective computing were sold as an add-on to that kind of service. An interesting and more specialized branch of affective computing involves robots such as the emote project (www.emote-project.eu). This "artificial tutor" approach has many interesting possibilities. It uses a robot's movements to strengthen affective feedback with the student, but it has the drawback of needing a physical robot. The latter is likely to make this approach more costly for education institutions and delay implementation.

Successful affective computing will most likely involve a complex architecture in order to combine sensor input and provide an accurate response in real time. Mobile learning via cloud services and handheld devices, such as smartphones and tablets, is likely to play a key role in the first few generations, with a larger market penetration due to the relatively controlled ecosystem it provides (high-capacity computing combined with a discrete device with many sensors). As content (for example, textbooks) becomes more digitized and is consumed on devices that have several additional sensors (for example, tablets with cameras and accelerometers), interesting opportunities will arise to mash up the capabilities of, for example, Knewton's Adaptive Learning Platform and ThirdSight's EmoVision, making affective computing for untutored learning more accessible. This could potentially increase the number of data points available for statistically based adaptive learning.

Altogether, this merits a position that is still in the trigger phase, with at least 10 years until it reaches the Plateau of Productivity.

User Advice: Most institutions should only continue to follow the research and development of affective computing in education and other industries. However, in order to be prepared for the strategic tipping point of implementation, institutions should start estimating the potential impact in terms of possible pedagogical gains and financial impact, such as increased retention for online learning. Institutions with a large online presence, or that want to exploit the hype for brand recognition, should get involved now. Partner with automotive suppliers, consumer electronics companies and universities (particularly online) to further explore this field.

Affective computing can involve collecting sensitive data about students, which makes it important to make sure that any privacy laws and concerns of the users are met (such as policy about if, when and how data is stored). Preferably, any use of affective computing should involve an "opt-in" process.

Business Impact: Affective computing is an exciting area with the potential to bring back a bit of the lost pedagogical aspects of classroom learning and to increase the personalization of online learning. One important advantage of this technology is that, even if it is inferior to a face-to-face student-teacher interaction, it scales well beyond the 100-plus-student lectures that today offer limited individual pedagogical adaptivity. A potential complement or competition to remedy the scalability problem is the social-media-based peer-mentoring approach, as exemplified by Livemocha and, more lately, by massive open online courses (MOOCs). In the Livemocha example,

a sufficient scale of the community of quality subject matter mentors can be reached by tapping the full Internet community of more than 2 billion users.

In general, affective computing is part of a larger set of approaches to further personalize the educational experience online. Another example is adaptive learning that depends on the statistical data of learners in the same pedagogical situation. It is also related to context-aware computing in general.

The ultimate aim of affective computing in education is to enhance the learning experience of the student, which should result in tangible results like higher grades, faster throughput and higher retention. These results will benefit students, institutions and society.

Benefit Rating: Moderate

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: Affectiva; Affective Media; IBM; Pearson Education; ThirdSight

Recommended Reading: "Business Model Innovation Examples in Education"

SIS International Data Interoperability Standards

Analysis By: Jan-Martin Lowendahl

Definition: Student information system (SIS) international data interoperability standards are the data formats needed to facilitate and even automate global student mobility.

Position and Adoption Speed Justification: Increasing political pressure, such as the Bologna Process, generally focuses on recruiting international students, and awareness of the costs associated with processing international applications has sparked activity in standardization. Earlier work, such as the eduCourse schema supported by the Shibboleth project, has been followed by several other standards, such as Metadata for Learning Opportunities. Now, momentum is building through the vendor community's involvement. This can be seen through the actions of the IMS Global Learning Consortium and the Rome Student Systems and Standards Group (RS3G), which have initiated activities focused on international SIS interoperability. RS3G continues to work with existing EU efforts to advance needed standards, and to raise awareness in political/administrative circles for this important standards-related issue for improving student mobility. Most of the latest activities have been political rather than technical in nature, but actions such as the Groningen Declaration (www.groningendeclaration.org) continue to show the global interest in student data mobility. In the U.S., the Postsecondary Electronic Standards Council (PESC) is succeeding in establishing standardization efforts in several areas. The latest national activity involving PESC and InCommon (operated by Internet2) is called the Common Identity and Trust Collaborative (CommIT) project. Its aim is to "address and resolve the many challenges associated with authentication in the admissions process." Since this project is associated with the global higher education community "standard" for federated identity and access management (Shibboleth), it is likely to play a role in international student mobility. However, these activities are still at too early a stage to establish true

international interoperability. As a result, SIS international data interoperability standards still merit a relatively early position on the Hype Cycle, and they will be on the road toward the Plateau of Productivity for at least five to 10 years.

User Advice: Institutions that expect to recruit extensively from abroad must monitor developments closely to be ready to adopt as soon as possible. They should work through their vendors or consortiums to establish a road map for adoption. The window during which this can be a competitive advantage is likely to be relatively small, and institutions should anticipate that not having the capability of a streamlined application process enabled by SIS standards can quickly turn into a competitive disadvantage. However, when considering this capability, it should be noted that standards usually take longer than technologies to mature and be accepted on the Hype Cycle.

Business Impact: SIS international data interoperability standards have a direct impact on the ability to recruit the right students to the right courses, as well as on costs for handling applications. The visibility and scrutiny of institutional course offerings will increase with the PriceRunner-type comparison sites that will likely develop, and it will be important to master the factors that lead to applications from the "right" student profiles. In particular, interoperability of student data will enable a higher degree of process optimization, driving down cost and risk. Standardization at this level will also facilitate economies of scale of administration through shared services, which will benefit the national or state education system. In addition, standardization will facilitate big data projects that, because of SIS international data interoperability standards, will have to spend far less time on data normalization and data cleansing. Experience from big data projects could also be fed back into the SIS standards to improve the predictability of big data.

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Embryonic

Recommended Reading: "Findings: Bologna Process Demands True International Student and Course Data Standards in Higher Education Throughout the EU"

"Gaining Competitive Advantage in the Education Ecosystem Requires Going Beyond Mere Infrastructure to Exostructure"

BPO

Analysis By: Terri-Lynn B. Thayer

Definition: Gartner defines business process outsourcing (BPO) as "the delegation of one or more IT-intensive business processes to an external provider that, in turn, owns, administrates and manages the selected processes based on defined and measurable performance metrics." BPO offerings are placed into two major categories: horizontal-specific offerings (those that can be leveraged across specific industries) and vertical-specific offerings (those that demand specific industry vertical process knowledge).

Position and Adoption Speed Justification: Horizontal BPO is an established service in areas such as payroll and benefits management. Although it is used by education institutions, it still has not penetrated the education market to the same degree that it has the commercial market. Gartner's most recent survey shows that about one-quarter of respondents use traditional BPO.

Some confusion exists within institutions regarding the criteria and crossover among BPO, outsourcing, SaaS and cloud offerings. In BPO, operational decisions are made by the vendor, with the desired ultimate outcome/results specified by the institution via the contract. Here, Gartner discusses vertical-specific education BPO. Education BPO includes offerings such as student recruitment, enrollment and retention, grant management, institutional research (aka business intelligence), IT help desk and online academic programs.

Vertical-specific BPO is still a relatively new phenomenon, at least as a commercial offering. Few institutions have had the chance to try this new service, but interest is increasing among clients. Fueling this interest is the strong pressure on institutions to become more generally efficient and more effective, specifically in the areas of student recruitment, enrollment and retention. Because process maturity is generally low, and due to the caution that is traditionally found among education institutions, this is a slow mover on the Hype Cycle. However, growing financial pressure and demonstrated successes can change this prediction. In the United States, one of the areas in which BPO in education is gaining ground is financial aid processing. This process requires a high degree of automation, a "bubble" of staff at specific times in the academic year and integration with the basic student information systems (SISs) of institutions. There appears to be no overwhelming leader, but there are numerous local/metropolitan area vendors. Two fairly high-profile examples of BPO by the University of Canberra in Australia and Middlesex University in London have demonstrated good results, especially in the area of student administration. In both cases, the BPO vendor, without previous higher education knowledge, achieved process improvements as well as cost savings. Recently, Wichita State University adopted a Blackboard BPO offering to provide a one-stop experience for student services.

BPO is still relatively early in the Hype Cycle, and Gartner still expects it to take five to 10 years to reach the Plateau of Productivity. Although interest is mounting, there are limited vendor offerings and only a handful of success stories, both of which are required to convince institutions with (in some cases, centuries of) idiosyncratic business practices to standardize and turn over these processes to an outside provider. For this reason, BPO only makes a small move on the 2014 Education Hype Cycle. However, as the disruption of the education ecosystem progresses, BPO will be a strategic alternative, especially for institutions with a mission to provide large-scale education at a reasonable price point — with little strategic advantage in proprietary practices and attracted by the economies of scale that BPO can provide. It is for this reason that Gartner predicts expanded vendor offerings and an increased speed of adoption.

In education, K-12 lags behind with regard to BPO. A "not invented here" syndrome persists, and concerns about privacy holds BPO back. The growth of BPO has been impeded by the slow economy, which has meant that school agencies continue with legacy solutions and depend on existing staff members to meet business needs, even when those needs change.

User Advice: Education BPO is an interesting offering that is well worth investigating for reasons of quality, cost and focus of core resources. However, institutions considering education BPO need a

good understanding of their processes in general and must define clear interfaces between in-house and outsourced processes. Gartner recommends a phased transition. In addition, CIOs should have a comprehensive understanding of their service portfolios before they consider outsourcing business processes (understanding, of course, that the impetus for many of these initiatives begins with the business side and not the professional IT organization). Established, skilled resources for vendor management are a must. A clear understanding of privacy legislation and intellectual property rights (especially their safeguarding), as well as basic metrics, must be in place before a contract can be signed. One interesting lesson learned from the cases discussed previously is that the BPO vendor brought expertise in process design that considerably improved university processes. Such a change could not have been done from within due to resource constraints and an inability to think "outside the box."

Business Impact: The effect on the institution depends on the process that is chosen for BPO and the reasons for it. A likely assumption is that the effect will be mostly in the areas of efficiency, timeliness, effectiveness and quality improvement. However, for areas such as institutional research and analytics, the effect can be strategic if it leads to more timely access to higher-quality data to support decision making.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Blackboard; Ellucian; Ferrilli; QuScient Technologies; Wipro

Recommended Reading: "Higher Education Sourcing Survey, 2012: Increasing Interest in OSS and Cloud"

"Higher Education 'Business Model' Scenarios and Corresponding Strategic Technology Map — Everybody's U Leverages Scale of the Market"

"Higher Education 'Business Model' Scenarios and Corresponding Strategic Technology Map — All About U Seeks Speed to Market"

"Case Study: University of Canberra Achieves a Step Change With Offshore Outsourcing"

"Predictions for the Higher Education 'Business Model' Landscape in 2025 and Beyond Will Help CIOs Plan Now"

At the Peak

Citizen Developers

Analysis By: Ian Finley

Definition: A citizen developer is a user who creates new business applications in partnership with corporate IT. In the past, end-user application development (AD) was typically limited to single-user or workgroup solutions built with tools such as Microsoft Excel and Access. However, users now can build applications that serve a virtually unlimited number of users without IT's help or knowledge. IT can encourage user developers to come out of the shadows and be citizen developers by providing them with adequate support.

Position and Adoption Speed Justification: In an era of shoestring IT budgets, businesspeople are increasingly looking outside the IT organization for applications and building an increasing number of applications themselves. Today's rapidly changing business climate demands greater application agility, and IT's timelines are often too long to meet business needs. Although agile development methodologies can help IT respond to business needs more rapidly, a lack of resources often prevents a rapid IT response. Furthermore, resource constraints force IT to focus on only a few high-priority applications. Consequently, the long "tail" of applications needing development grows still longer. Finally, the tacit knowledge of businesspeople is often difficult to translate into project requirements, making IT AD projects slow and time-consuming for business end users. Sometimes it is faster, less expensive and better for end users to build the applications they need, rather than engage the IT AD group to do it.

These issues have existed for some time, but end-user developers are empowered by new forces, including the evolution of developer tools, the industrialization of infrastructure through cloud computing and changing workforce demographics. Many smaller vendors, and some large ones, such as Microsoft and salesforce.com, now provide powerful developer platforms that make it easier for end users to develop their own applications, even applications that once required IT AD skills.

Often cloud-based, some of these tools operate completely outside IT's view, requiring only a browser and a credit card to build, deploy and run an application, then make it available to anyone with access to the Internet. Finally, the growth of consumer computing has taught many in the workforce that they don't have to wait for IT to provide the hardware or software needed to do their jobs. By one estimate, three times as many workers now "program as part of their work" as professional programmers. The result of these combined forces is more end-user developers creating more applications of greater scope, outside of IT's visibility.

Citizen development is end-user AD with IT's blessing and support. In the past few years, we've seen an increasing number of IT organizations looking to address the challenges and harness the opportunities of end-user development by implementing citizen developer programs. We have also seen an increasing level of interest from vendors looking to provide platforms that can help IT organizations transform uncontrolled end-user development into managed citizen development. Although not yet at the Peak of Inflated Expectations, interest in citizen developers continued its slow growth during the past year.

User Advice: Although end-user AD has operated under the radar for years, IT now needs to engage with end-user developers more actively to enable them to be "good citizen" developers. The new, more powerful applications that end users are building have the same risks and rewards as some professionally developed applications, and they need an appropriate level of quality, security, performance and availability. Ignoring or attempting to prevent end-user development carries high

risks and limits enterprise innovation. Instead, IT should implement a citizen developer program to help end users be safe and innovative developers. Specifically, IT should:

- Embrace AD outside IT — Actively challenge and dismantle negative IT attitudes toward end-user AD. "Shadow development," away from IT oversight, generally occurs when working with IT is too slow, restrictive or expensive to meet business needs, not because end users are capricious or malicious.
- Set clear boundaries — Be proactive and engage with the business to design a citizen developer program that meets both business and IT needs. Ensure that the rights and responsibilities of IT, the citizen developer and the business are clearly defined.
- Support safe and effective end-user AD — Don't just roll out IT's tools to businesspeople. Instead, offer sanctioned development platforms that are end-user-friendly and enable IT staff to manage and monitor citizen development. Extend user support to include citizen development, and measure progress in the volume and sophistication of citizen-developed applications.
- Trust, but verify — Provide just enough governance to enable IT to review the quality, security, performance and availability of major end-user applications before they are deployed. Implement monitoring to detect end-user applications that could create risks for the enterprise, and develop procedures to handle them. Create a protocol for transferring responsibility for risky and problematic applications to IT.

Business Impact: A citizen developer program that includes IT guidance; IT-supported, end-user-oriented AD platforms; and just enough governance can create a safe environment for end users to unleash their innovative potential. By engaging with end users and helping them help themselves, IT can accelerate the exploitation of new technology, help end users create competitive advantage and new business innovations, and reduce the risks of modern end-user development.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Mendix; Microsoft; Oracle; RunMyProcess; salesforce.com; TrackVia; Zoho.com

Recommended Reading: "Citizen Development: Reinventing the Shadows of IT"

"Citizen Developers Are Poised to Grow, 2011"

"Case Study: Citizen Developers Can Help Business Keep Pace"

"New Developers Can Help Deliver More"

Open Microcredentials

Analysis By: Jan-Martin Lowendahl

Definition: Open microcredentials are about creating ecosystems of open digital "signs" or "badges" of accomplishments that can be used by an individual to indicate skills learned, no matter the circumstance (for example, in a university or in the workplace). The ideal situation is if a claim represented by an "open credential" is verified by a relevant trusted party and attached to a secure digital identity.

Position and Adoption Speed Justification: Microcredentials in the form of various badges or "points" have existed for some time in digital social environments in general and in learning environments in particular. The phenomenon is closely related to gamification and has won acclaim for its use by education ecosystem players such as Khan Academy. A key problem is that these environments are proprietary and closed, which makes it difficult to display achievements outside them. The aim of open microcredentials is to remedy that problem and to allow anyone to issue credentials that can be portably collected and displayed by an earner, and have a built-in verification mechanism back to the issuers. Creating a truly open and trusted microcredential ecosystem is a challenging task, but we believe that the Mozilla Open Badge Infrastructure (OBI) project can accomplish it. Its decision to go live with Open Badges 1.0 in March 2013 is the reason we finally introduced open microcredentials to the Education Hype Cycle last year. Since last year, many players in the education ecosystem — such as traditional heavyweight Pearson, Educational Testing Service (ETS), and new and innovative vendors edX, Degreed and Workforce.io — have committed to adopting the Mozilla Open Badges standard. In addition, innovative institutions such as UC Davis are experimenting with badges for core competencies that have been co-developed with employers. This exemplifies a key feature of the open-badge ecosystem that spans formal and informal education as well as employer recognition.

This merits a jump just into the Peak of Inflated Expectations phase. We expect a relatively quick uptake of open microcredentials, with closer to five than 10 years to the Plateau of Productivity. However, that speed could be hampered by issues related to identity management of individual earners and trust in issuers, as well as by potentially competing ecosystems provided by players that still believe in the old strategy of walled gardens rather than open ecosystems.

User Advice: For education institutions, issuing open microcredentials is a great new technology-based capability that will provide more value and motivation to students. It is a low-cost, high-value option to improve student experience. If designed properly, it can give the institution more data about its student population. Furthermore, it can build the institution's brand and help market it.

For institutions, it is crucial to set a clear policy about when it is appropriate to issue a microcredential in the name of the institution. The institution should also make sure that the verification mechanism is clear and that the graphical design of the microcredential is aligned with the brand. If possible, the institution should encourage the earner to tie the microcredential to digital identities that are not self-certified.

If the institution plans to accept microcredentials for any kind of application, staff and faculty need to be educated about how to verify microcredentials.

Business Impact: At the very least, open microcredentials bring a promise to do what the e-portfolio never quite managed — that is, to create portable recognition for achievements on a global scale. This is a good impact in itself and can improve the mobility in the workforce, leading to better

fit between skills and employment. At the other end, this is another potential threat to the traditional education institutions that rely on the value of government-accredited degrees. If Open Badges is a success (that is, it is accepted by employers), it will make open, but individualized, programs of study for credit or noncredit stronger in their competition with the many community colleges and public institutions that have limited entrance restrictions and are driven by a clear government mission to provide cost-effective, accessible and relevant education.

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: Mozilla Open Badges

Recommended Reading: "The Gartner Higher Education Business Model Scenarios: Digitalization Drives Disruptive Innovation and Changes the Balance"

"Governments Need to and Can Play a Role in the Online Claims Ecosystem"

"Gaining Competitive Advantage in the Education Ecosystem Requires Going Beyond Mere Infrastructure to Exostructure"

"Visual Strategic Planning Using the Gartner Higher Education 'Business Model' Scenarios and Corresponding Strategic Technology Maps"

"Cool Vendors In Education, 2014"

Open-Source SIS

Analysis By: Terri-Lynn B. Thayer

Definition: Open-source education student information systems (SISs) are developed via open-source or community source models..

Position and Adoption Speed Justification: Open-source SIS has the potential to be part of a nonproprietary education administrative application suite or a best-of-breed solution. However, features, functionality, processes, integration and support vary widely.

There is an increasing number of solutions for K-12. Many of these open-source solutions, however, have a close affiliation with only one commercial vendor, and some specifically discourage community participation — an element considered a hallmark of open-source projects. It is important to note these limits to vendor choice and participation, as they may result in the same vendor lock-in and lack of control often associated with proprietary vended systems. Nevertheless, these solutions offer important alternatives, especially in developing countries or institutions with simpler requirements and limited financial resources (such as trade schools and hospital-based institutions).

Along with the growing K-12 options, user adoption is also growing. OpenSIS, from Atlanta-based OS4Ed, has thousands of U.S.-based users and has been downloaded worldwide 20,000 times. Fedena, developed by India-based Foradian Technologies with the Web framework Ruby on Rails, is an award-winning initiative that has been downloaded by tens of thousands of schools. Fedena is available in a SaaS option, integrates with Google Apps and Moodle and supports many languages. As with many of these solutions, Foradian Technologies offers premium modules and add-ons, such as multischool support, as well as a marketplace for other vendors to provide added functionality. A newer initiative in Africa, A1 Academia, is committed to providing an open-source software (OSS) SIS and is in production at a handful of higher education institutions.

A promising, but complex, higher education-focused offering is Kuali Student (KS), the Kuali Foundation's open-source SIS. The foundation has released the curriculum management module with several schools in production; enhancements are expected in late 2014. The system is modular in design and is intended to be implemented using a phased approach. Future modules include academic planning, course offering, student registration and academic records, with anticipated availability in 2014 to 2015. Financial aid functionality is planned for 2016. Admission functionality, however, is not yet on the road map and might never become a suite element, as institutions increasingly turn to commercial CRM and BPO offerings. The Kuali Foundation's success in forging partnerships with about a dozen commercial vendors to contribute to and support its offerings is very important. This strategic move provides institutions that wish to adopt a Kuali offering a method of consistent and professional support and hosting options; other open-source initiatives have been negatively impacted by a lack of these options.

Other positive trends include the moves of several European national SIS consortia toward OSS or community source licensing, even if there is hardly a community of a critical mass of skills. However, there is the potential for collaboration among the different initiatives if momentum builds for interoperability components, such as OSS higher education middleware suites and SIS international data interoperability standards.

As new cloud SIS market offerings emerge in the coming year, they will threaten OSS SIS, particularly in competing for the mainstream higher education market. This will be a crucial challenge for OSS SIS; delays or failures could thwart continued movement along the Hype Cycle and result in OSS SIS being a niche solution that may fail to reach the Plateau of Productivity.

User Advice: OSS for SIS is still in an early stage of maturity and adoption, with far more options available for K-12 than for higher education. Users should carefully evaluate choices, as many K-12 solutions are developed and supported by a single commercial vendor, which may result in vendor lock-in.

The only viable option for mainstream higher education is Kuali, but the system currently has limited functionality. Kuali is a modular design, so institutions looking for curriculum management software should consider Kuali as a possible stand-alone component that does not require committing to the entire SIS.

Internationalization requirements will play a prominent role in evaluating these solutions. Institutions should assess their drivers for interest in OSS. If the ability to participate in community development is a driver, CIOs should note that this is a differentiator between solutions available today. CIOs

should then evaluate the solution technology stack to determine what best aligns with their architecture and staff skills.

Unless users intend to develop the staff resources necessary to implement and support their own OSS SIS, they should make sure their locale has a viable commercial support partner for implementation, optional hosting and long-term support.

Business Impact: Student administration and possibly integration with e-learning platforms and administrative back-end systems (for example, finance and human resources/payroll) will be affected areas. Although lower licensing costs are an advantage of commercially supported open-source offerings, additional benefits may or may not include user control of the code and lack of vendor lock-in. As vendors continue to open their systems and commercial bolt-on products become available, the entire ecosystem of administrative applications will be positioned to be more cost-effective and contribute a more positive ROI to institutions.

Benefit Rating: Moderate

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: A1 Academia; Focus School Software; Foradian Technologies; Kuali Foundation; Learners Circle; OS4Ed; SchoolTool

Recommended Reading: "Higher Education Sourcing Survey 2012: Increasing Interest in OSS and Cloud"

"Student Information Systems in the North American Higher Education Market"

"Overview of Kuali Administrative OSS Offerings for Higher Education"

Student Retention CRM

Analysis By: Terri-Lynn B. Thayer

Definition: Student retention CRM is defined as applications that are used by higher education institutions to identify and engage at-risk students, assess their progress as their risk is noted, create and track engagement plans, and enable successful intervention strategies. Some of these applications are mainstream CRM, and others were not originally designed as CRM applications but evolved from other education sector applications.

Position and Adoption Speed Justification: Student retention CRM is the centerpiece of the three CRM types in higher education, bounded on either side by the student enrollment CRM at the beginning of the student life cycle and alumni CRM at the end of the student life cycle. The functionality is a combination of analytics for assessing the risk of withdrawing — often referred to as "early alert" — with the workflow tools that assist the academic administration to support and help students in regard to the goal of maintaining their registration and academic progression.

These applications make increased use of social and mobile solutions to engage the students and sometimes employ techniques previously used in alumni development for community building. However, student retention CRM systems are still in an emerging stage because the education industry is still struggling to determine exactly what attributes can best predict failures early enough in the process to enable productive intervention. Student success and improved student engagement is one of the top business trends in higher education today, driven by an increased emphasis on retention rates, speed of degree completion and public scrutiny of student outcomes. The previous tendency in higher education to let students sink or swim is changing; therefore, it is expected that more rigorous business practices, similar to those now used to engage prospective students at the beginning of the student life cycle and those employed to engage alumni at the end of the student life cycle, will move into the matriculation phase of the life cycle at an increasing rate and drive demand and maturity in the solutions. Although the strong emphasis on retention solutions began at for-profit institutions, it is moving into state-sponsored and private, not-for-profit institutions due to this increased oversight and attention. In fact, the level of student engagement during the period of enrollment at an institution may prove to be a useful indicator of postgraduation giving and volunteerism, ultimately making these systems attractive to even the most selective institutions where retention per se is not an issue.

Although the adoption rate of fully functional student retention CRM is low to moderate today, many institutions have implemented bits and pieces of this functionality. However, institutions are increasingly taking an institutionwide view of the student life cycle and bringing together campus stakeholders to unify or limit CRM solutions across the academy. In these instances, they are sometimes replacing point solutions with more holistic CRM offerings. A major objective of these institutional CRM initiatives is the desire to collect data to provide a 360-degree view of the student. Administrators are interested in a mounting array of analytics to track reasons why students leave an institution, including those reasons that are not related to academic achievement. Some student retention CRM systems provide the ability to track anecdotal data that is provided by faculty members (for example, a student who falls asleep in class) as well as integrate with other campus systems that provide clues to student engagement (for example, dining, housing and card access). The holy grail is to interface these student retention CRM solutions with campus big data initiatives for increased retention and improved student outcomes through better curriculum design, student course and concentration selection, faculty performance and so forth. Ultimately, the data that is mined here may support predictive analytics for more effective student recruitment — enabling institutions to pick the students most likely to succeed.

Due to the high demand, there is a growing number of vendor options, and Gartner expects choices to continue to expand. Tremendous anticipation exists that these solutions will be key to solving the aforementioned issues. As institutions work through what may be difficult implementations, require faculty participation to track data and measure true results, Gartner expects that some disappointments will occur that will push student retention CRM toward the Trough of Disillusionment but that also will provide valuable industrywide enlightenment about what works and what doesn't.

User Advice: It is often easier and more cost-effective to retain a student than to recruit a replacement.

Users should consider the increases in student retention functionality in this area from student information system vendors and learning management system vendors; however, they should also watch the continued development and sophistication of independent, third-party systems in the education ecosystem. Additionally, established CRM vendors are increasingly licensing their platforms as the foundation for higher-education-specific products. Buyers should not only carefully assess the functions that are provided in this area by learning system vendors in measuring academic engagement and success, but also should determine how these retention systems address nonacademic factors, such as student financial pressures, student behavioral problems, and student adjustment and maturity issues — all of which can have a significant effect on retention rates. Student retention algorithms are still not well-understood; therefore, institutions should look for solutions that provide significant flexibility for alerting functions and data analysis techniques, as well as open APIs for integration with a wide variety of campus systems and external data sources, to ensure that their investment will have maximum longevity.

Business Impact: In addition to the obvious social good of helping students to be successful and receive value for their tuition and fees, it is often a good financial decision to implement a system that helps to retain students and stop the "bleeding" of revenue from student-based tuition and fees. Such systems will assist institutions in maximizing the student lifetime value to themselves. Additionally, institutions are faced with public demands and regulations to improve graduation rates and the time-to-degree completion — both will be supported by these solutions.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Ellucian; Enrollment Rx; GradesFirst; Hobsons; Starfish Retention Solutions; TargetX

Recommended Reading: "The Coming of Age for CRM in Higher Education"

Adaptive E-Textbooks

Analysis By: Jan-Martin Lowendahl

Definition: An adaptive e-textbook offers a learning experience that personalizes the learning process in higher education. Powered by technology such as that from Knewton or McGraw-Hill's SmartBook, an adaptive e-textbook offer customized student interactions with the digital content based on individual and aggregate achievement data plotted against a learning map.

Position and Adoption Speed Justification: The concept of adaptive learning dates back to the 1950s with the introduction of artificial intelligence and computers playing a role in education. As IT has evolved, computers have become smaller, more powerful and less expensive. With this evolution, adaptive learning is being implemented in classroom learning, distance learning and tutoring scenarios. Companies such as Sherston Software, Carnegie Learning, Knewton and Pearson (SuccessMaker) offer adaptive learning systems and applications, making this form of

personalized learning relatively mainstream. The key elements of adaptive learning done through interactions with e-textbooks are learning or subject-specific knowledge maps, content, achievement data (individual and aggregate) and algorithms that create individual matches of content and student.

While progress has been made in the areas of content and perhaps even advanced knowledge maps, data remains an issue as a component to push adaptive learning from hype to reality. The May 2014 shuttering of InBloom, a high-profile aggregate data solution provider for adaptive learning, shows the major obstacle to sustainability for this market. InBloom was cited for its weakness in providing security for individual student data. As one provider commented, data on individual students and students at an aggregate level is what provides the ability to create individual learning journeys. A major publisher added that there can never be enough data available to create successful adaptive learning experiences, which illustrates the challenge ahead for adaptive learning.

Adaptive learning is a hot topic in all education circles, with a number of new entrants in the space, some of which bend the definition of adaptive learning beyond its core understanding. Venture capitalists are pouring money into the space, clearly understanding the promise of creating individual learning experiences, but if issues concerning elements such as data are not resolved, the hype will continue to be larger than the current opportunity.

User Advice: Adaptive e-textbooks pose an interesting issue for CIOs in education related to the data needed to bring out the full capabilities of these new digital learning tools. Some of the data — as in the case of a student's interaction with a given e-textbook, can be gathered in the cloud by the e-book publisher, but other data streams (longitudinal data) must be provided by the educational institution and then incorporated into the e-textbook. This challenge is a nontrivial matter for IT departments.

Clearly, data remains the biggest concern for those tasked with guarding this important element of academia. Despite the promise that adaptive learning brings to students, IT leaders must remain vigilant in safeguarding student data until proper measures are put in place that offer security and assurances that data will not be used for anything other than adaptive learning applications.

It is clear that adaptive e-textbooks will have an impact on all areas of education, so it would be prudent for all constituencies to prepare by developing IT-led groups (with representation from all stakeholders) to determine:

- **Data policies:** What data is necessary for success? How much data needs to be collected for statistical validity? What privacy safeguards should be put in place?
- **Content vision:** Speak to leaders in the adaptive space to gauge the impact on your current learning materials and what can be done to evolve archived material into becoming adaptive-ready. Work with educators to build uniform platforms to create, deliver and assess new adaptive material and understand its interaction with current LMS investments.

Business Impact: The business impact is big, given the impact adaptive learning could have for students. Adaptive learning truly falls into the "high risk, high reward" category, with a number of stakeholders potentially owning a piece of the pie. For publishers, adaptive e-textbooks show a

great deal of promise. Most of the larger educational publishers have the resources to invest in building adaptive e-textbooks (for example, McGraw-Hill). These rich digital textbooks could allow educational publishers to halt the erosion of existing revenue, as well as show value against lower-cost and free resources. For software and platform providers, offering open and scalable solutions that differentiate based on content and the ability to "adapt" a wide range of leaning materials would lead to a successful, sustainable business proposition.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: DreamBox Learning; Knewton; McGraw-Hill

Recommended Reading: "Adaptive Learning Looms as an E-Textbook Game Changer"

Big Data

Analysis By: Jan-Martin Lowendahl; Bill Rust

Definition: "Big data," in general, is defined as high-volume, high-velocity and high-variety information assets that demand cost-effective, innovative forms of information processing for enhanced insight and decision making. Big data in education is associated with collecting vast amounts of data from students' digitized activities, transforming that into information and producing or recommending actions aimed at improving learning outcomes.

Position and Adoption Speed Justification: Big data in higher education, in general, has been around for decades, mainly focused on research. It started with large datasets in empirical and field research, and subsequently added huge datasets from fields such as astronomy, as well as computational and bioinformatics research. However, big data in education is more recent, and has been enabled by more and more of our lives being lived and recorded online. Examples include student information systems (SISs) for grades and demographics, learning management systems (LMSs) for learning, CRM systems for student and alumni relations, Facebook for social interaction and sometimes even smartphones (Internet of Things, or IoT) for location data.

Harvesting this data in sufficient volume and detail can enable the vision of new correlations and, above all, establish the statistical significance between actions and outcomes. CRM systems can go from providing just early warning to optimal fit (which and how many courses in which type of institution), and learning platforms can go from "one size fits all" to adaptive learning. Herein resides the promise of a more intelligent evolution of the education ecosystem that can remedy the failure of Industrial Age education to address differences between and among students' learning characteristics.

The Predictive Analytics Reporting (PAR) Framework project run by the Western Interstate Commission for Higher Education (WICHE) Cooperative for Educational Technologies and the adaptive learning tools created by Knewton and Carnegie Learning are examples of capabilities

based on proprietary big data. In addition, MyFit (acquired by Naviance — see "Cool Vendors in Social Software and Collaboration, 2010") offers an innovative way of harvesting self-reported data on Facebook and, for example, turning it into advice when choosing a college. The big data trend will introduce particularly interesting dynamics in the education ecosystem, since, in order for big data to be really effective, the dataset must be bigger than most institutions can collect on their own. Already, the PAR Framework project combining data from big, traditional universities, community colleges and for-profit organizations is an interesting example that keeps growing. It now has more than 20 members providing more than two million student records. The PAR Framework project's release of the data definitions as a Creative Commons license is a major step forward, and is a possible competitive advantage over commercial competitors such as Civitas Learning (see "Cool Vendors in Education, 2013"). Will that collaborative trend gain traction, or will competition kill this initiative? What are the implications for privacy laws? Where should the line for anonymization be drawn to be useful for good statistical correlation, as well as for personalized feedback, while allowing for privacy? Will similar collaborative efforts, such as attempted by the now-defunct inBloom, overcome questions of data ownership and take root in big, national K-12 systems?

A clear endorsement that national governments expect much from big data has come from the U.S. Department of Education. There, multimillion-dollar grants are given to individual states to develop Statewide Longitudinal Data Systems. Moreover, the Department of Education's draft issue brief, "Enhancing Teaching and Learning Through Educational Data Mining and Learning Analytics," is intended to inform education stakeholders about how big data can be applied within online learning systems to support educational decision making. At the same time, several new vendors (including Carney Labs with Mari Games and Intellify Learning) are betting on the big data trend: the idea of collecting and integrating data from multiple data sources to provide data-driven decision making — both for faculty and students, as well as for leaders of institutions.

Big data is still within the Peak of Inflated Expectations, as many new competitors join the race. But the first-generation experience is starting to emerge, and we expect big data to enter the Trough of Disillusionment phase soon, as we learn what works and what doesn't. There is a possibly bumpy five- to 10-year road on the way to the Plateau of Productivity and mainstream adoption. However, that can change quickly if standards mature, and if there is sufficient interest and funding from national and state governments.

User Advice: Many higher education institutions can draw on previous experience with big data in the research community. Meeting the computational needs for handling big data should not be a problem, based on experience with high-performance computing, grid computing and, now, cloud computing. The big challenges reside in categorizing the data — making sense of the data, based on plausible theories or hypotheses, and avoiding pseudocorrelation, which is always a problem in these kinds of statistical analyses. However, again, this is not new to the higher education community, and research methodologies exist. There is less experience with large datasets in K-12 education, and an additional impediment is the fear, uncertainty and doubt (FUD) expressed by stakeholders — especially parents — regarding the possible use of the data by those outside their immediate educational community.

From a practical standpoint, international collaboration would be immensely facilitated if there were more open standards developed for big data. Examples include SIS International Data

Interoperability Standards, Metadata for Learning Opportunities and the opening up of the proprietary standards behind, for example, Knewton's knowledge graphs. The PAR Framework, published under a Creative Commons license, is a particularly good example of how collaboration can be facilitated using simple, established open-source licenses. In this complex endeavor, we recommend a learning-by-doing approach, and joining (or at least studying) the PAR Framework project experience. This is the most-advanced, openly available information in higher education, to our knowledge. A final caveat in this context is that ownership and privacy issues are potentially huge, and must be taken seriously.

Business Impact: Big data is an important piece of the puzzle in solving the biggest problem that faces education today: cost-effective scalability with retained and, preferably, improved quality. Being able to offer the right courses and programs (learning opportunities), as well as testing pedagogical approaches to increase grades and examination pass rates (improving learning outcomes), based on statistically valid big data, would be invaluable to students and to society as a whole. Using big data to finally break the logjam of student progress created by the archaic (if not arcane) seat time requirements in K-12 education will pay immediate returns in the efficient and effective delivery of instruction.

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Carney Labs; Civitas Learning; Intellify Learning

Recommended Reading: "The Expanding Education Ecosystem: A World of Choice"

"Cool Vendors in Social Software and Collaboration, 2010"

"Cool Vendors in Education, 2012"

"Cool Vendors in Education, 2013"

"The Importance of 'Big Data': A Definition"

"A Quick Look at Big Data in Education, 2012"

Sliding Into the Trough

COBIT

Analysis By: Simon Mingay; Jan-Martin Lowendahl

Definition: COBIT, owned by ISACA, originated as an IT control framework, and COBIT 5 has evolved into a broader IT governance and management framework for the purpose of ensuring that the organization's investment in IT will enable the achievement of its goals. COBIT 4.1 was, and still

is, used by many midsize to large organizations across a wide range of industries — and is more selectively used in education — to implement controls to manage key risks or meet an audit or compliance requirement.

Position and Adoption Speed Justification: COBIT 5 was a major initiative by ISACA to bring together many of its frameworks into a single governance and management framework. There is very limited mapping between COBIT 4.1 and COBIT 5. Most notably, COBIT 5 uses the concepts of governance and management practices rather than control objectives. Although COBIT 5 was released in April 2012, education organizations and beyond continue to be cautious in their adoption of it, preferring to make use of the more established COBIT 4.1 until COBIT 5 has proved itself.

In general, the impact of COBIT 5 on the education sector is limited. It is being applied, though, where a more centralized approach to IT governance is being attempted. The style of governance is changing in education due to greater competition, where institutions are being influenced by best practices outside of the sector, or where external auditors have been involved in reviewing IT activities. However, absent relevant compliance or external reporting issues, without external auditors pressuring organizations to adopt COBIT, and considering the challenges of enforcing standard processes and controls within an educational environment, COBIT is unlikely to be widely adopted. Those that do use COBIT use 4.1 in a very selective and tactical way to implement controls that manage key risks and security issues. Few use it as a broad framework to manage and govern the creation of value from IT.

Gartner saw a decline in client inquiry on COBIT in 2013 and continues to see a decline in 2014. As such, COBIT is moving toward the Trough of Disillusionment. We also do not believe it will reach the Plateau of Productivity on the Hype Cycle in the education sector for another 10 years, which is a change from last year, when we believed it would achieve this in less than 10 years.

User Advice: Even with the COBIT 5 update and its integration of ISACA's many frameworks, the focus of this high-level framework is on what must be done, not how to do it. Therefore, IT management has typically used COBIT 4.1 as part of a mandated program in the IT organization and to provide guidance regarding the kind of controls needed to meet the program's requirements. Process engineers can, in turn, leverage other standards, such as ITIL, for additional design details to use pragmatically. Despite COBIT 5's expansion, it still complements, rather than replaces, ITIL.

Because COBIT 5 has adopted the International Organization for Standardization (ISO) 15504 process maturity model and also incorporates COBIT 4.1, Val IT 2.0, Risk IT, Business Model for Information Security (BMIS) and the Information Technology Assurance Framework (ITAF), COBIT 4.1 expertise will have limited applicability to COBIT 5. Consequently, a major training and familiarization exercise must be undertaken by organizations adopting COBIT 5 as a successor to COBIT 4.1. This is part of the reason for the slow adoption of COBIT 5.

Those IT managers who want to gain insight into what auditors will look for, or into the potential implications for compliance programs, should also take a closer look at COBIT. Any IT organization facing a demand for wholesale implementation should push back and focus its application in areas in which there are specific risks in the context of its activities.

In particular, CIOs should talk to compliance, internal audit and any other relevant stakeholders to discuss future plans before adopting a particular version of COBIT or accepting an audit against a specific version.

Business Impact: While v.5 moves COBIT toward a broader management and governance framework, it is seen by most users as a framework for effective governance and risk reduction. Management should review how COBIT 5 can be used to enhance governance practices and help better manage risks and, thus, result in improved performance. COBIT's usefulness has moved a long way beyond a simple audit tool. Note, though, that the lack of compatibility with earlier versions will necessitate an extensive training program for all those impacted by adoption of COBIT 5.

Large or complex institutions will likely find greater financial and performance benefits through improved governance, especially if COBIT is used as one of several tools to identify and rectify weak links between demand governance and supply governance of IT services (see "Gartner Defines 'Governance'").

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Recommended Reading: "IT Audit Standards, Frameworks, and Guidelines for Auditees and Auditors"

Enterprise Mobile App Stores

Analysis By: Jason Wong; Monica Basso

Definition: Enterprise mobile app stores support role-based application discovery and downloads through a local client or browser storefront on a mobile device. Enterprise mobile app stores are an important component of an overall software application strategy because they enable organizations to curate, provision and deploy relevant applications for employees and partners.

Position and Adoption Speed Justification: Enterprise mobile app stores offer a similar paradigm to public stores (such as Apple's App Store), but are private and implemented on internal servers or are delivered through private or public cloud services. Unlike consumer app stores that are open to the world, enterprise mobile app stores are closed environments that allow IT and admins to create workflows to submit, inspect, approve and assign applications that meet enterprise requirements for a variety of workgroups. An increasing number of enterprise portals promote applications that employees should or are recommended to download, either by passing through to the store or from local storage. Private mobile app stores are critical for organizations with many mobile applications to support easy discovery and distribution of applications to the mobile workforce and customers, and to provide additional security controls and management capabilities.

Enterprise Mobility Management (EMM) vendors, such as AirWatch, MobileIron, Good Technology, SAP, IBM MaaS360 and Citrix provide corporate app store capabilities as part of their offerings. Private or enterprise app store capabilities can also be found in offerings from mobile application management (MAM) vendors such as BMC's AppZone and Apperian, and from mobile application development platform (MADP) vendors such as SAP, Pegasystems and Kony. A few vendors like Citrix and BMC are unifying their corporate app store for mobile, Web, SaaS and Windows applications, going beyond mobile devices to support any endpoint client.

IT organizations' demand for private mobile app stores keeps growing as mobility adoption rapidly takes place. We expect that it will take two to five years before reaching the Plateau of Productivity because many organizations are exploring app stores as a standard for mobile application distribution. Factors that may limit a broader adoption in the short term include lack of market maturity, costs and the viability of legacy business applications in new app stores. However, the pressure to implement safe enterprise app stores will grow as employees increasingly use personal mobile, Web and cloud apps at work, and as IT organizations understand the associated risks. Hence, we expect a growing number of organizations to implement enterprise app stores during the next few years.

Although most EMM and large MADP vendors today offer basic enterprise app store functionality, only a few provide a comprehensive solution for complex application deployment scenarios. The current market is not quite mature but will expand during the next few years. We expect that more players, including EMM, MAM and MADP vendors, will start offering integrated capabilities, as will new entrants such as system integrators and service providers that will launch enterprise mobility services that include outsourced enterprise app stores. App stores for PC and desktop Web applications may take much longer to mature.

User Advice: Enterprises should evaluate private mobile app stores to support enhanced application delivery and management for their mobile workforce. They can help improve the modularity, user experience, standards compliance, platform compatibility, provisioning, security and distribution of the application portfolio.

Business Impact: Enterprise mobile app stores can help software asset managers lower administration overhead and drive cost accountability. The app store can help manage traditional software licensing models, SaaS subscriptions, and other, more elastic on-demand cloud provisioning models by automating the capture of license, subscription and cost assignment data during check-out. More mature enterprises can use app store data to manage ongoing maintenance and support costs and to drive better accountability through more sophisticated and accurate analytics.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: AirWatch; Apperian; BMC Software (AppZone); Good Technology; IBM (Fiberlink); MobileIron; SAP; Symantec; VMware

Recommended Reading: "Magic Quadrant for Mobile Device Management Software"

"Enterprise App Stores Can Increase the ROI of the App Portfolio"

"Regain Control of Mobile Software Licensing With an Enterprise App Store"

"There's an App for That: The Growth of Enterprise Application Stores"

"The Foundation of a Successful Enterprise App Store"

Learning Stack

Analysis By: Jan-Martin Lowendahl; Marti Harris

Definition: A learning stack as an architectural construct is a collection of elements, such as applications, personal productivity tools, cloud services, content repositories and data sources, that can be accessed through a context platform. The learning stack is dynamic. Elements can be added, updated, removed and replaced in the open structure of the context platform.

Position and Adoption Speed Justification: The development and adoption of the learning stack concept will follow the adoption of the open structure of context platforms and open standards, such as Learning Tools Interoperability (LTI). As the learning platform becomes more generic, the learning stack and the elements in the learning stack can become more specialized to academic subjects, in addition to including general-purpose elements. An element in the stack that is subject-specific may be accessed through the context platform by a specific group of users, making it a social learning platform. General-purpose elements in the stack could include cloud services and collaboration tools available to all users of the context platform.

Uptake of the learning stack depends on the move away from point solution learning systems and toward a well-developed exostructure with a mature collection of education-specific standards. The learning stack is gaining ground. Increasing interest in new standards, such as Caliper, and increasing experience in the use of, for example, LTI show that institutions and providers are gathering the experience needed to move learning stacks safely through the Trough of Disillusionment.

User Advice: When looking to replace learning systems with next-generation context platforms, continue to examine the open structure of learning platforms and its ability to support the learning stack concept. This will ensure strategic decisions can be made regarding the choice of a platform and elements in the learning stack. Institutions that have introduced application suites, such as Office 365 and Google Apps for Education (GAFE), should consider their placement within the learning stack.

Business Impact: Providers of learning platforms should offer an open structure to meet users' expectations for easy access to collaboration, communications and content within their learning environment. Publishers of educational digital content will find new opportunities to present subject-specific applications as elements in the learning stack. Students will have more access to elements within the learning stack to allow for bottom-up use of learning platforms without requiring faculty

members to direct learning activities. If the use of massive open online courses (MOOCs) becomes a part of the students' profiles of learning content, then inclusion in the learning stack should be considered.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Wireless as a Service

Analysis By: Jan-Martin Lowendahl

Definition: Wireless as a service (WaaS) in an education context is when an institution buys wireless services from an external service provider to complement or replace its own network access.

Position and Adoption Speed Justification: As more and more education, research and administrative services are delivered as IT services, reliable network access has become not only fundamental, but also critical. Furthermore, we see several clients struggling with infrastructure upgrades just to keep up with bandwidth and access demand as a result of changes in user patterns — for example, bandwidth-hungry lecture capture and retrieval services as well as access-point-hungry mobile devices. However, the real challenge is not campus access; rather, it is mobile learning, which brings with it another dimension in scale. Researchers and students have come to expect seamless "anytime, anywhere" access to institutional IT services, much like telcos' subscription packages and Web consumer services. With the increasing dependence on hybrid and online learning, institutions face the challenge of how to ensure scalable quality access and support for students beyond the confines of the campus.

WaaS has existed for some time, predominantly as a consumer-grade service based on 3G, and many institutions have negotiated deals with telcos to provide or subsidize network access as part of a mobile phone subscription. 3G networks have not had enough capacity and coverage area to be a real alternative to Wi-Fi. However, the increasing availability of 4G, together with corporate subscription services from a few telcos, provides new opportunities to offer students and researchers the cost-effective, ubiquitous bandwidth access they expect. Some telcos even offer platform as a service (PaaS) as an alternative to run institution-specific applications, which further spreads the risks and increases the options for load balancing and business continuity. Further developments in which National Research and Education Networks (NRENs) act as "trusted brokers," and introduce services like Janet 3G, are expected to accelerate WaaS adoption. When an NREN acts a trusted broker to sort out legal, contractual and education-specific security issues, and to build on established authentication services such as "eduroam" (education roaming), the barrier to adoption is lowered considerably.

It is still relatively early in terms of 4G infrastructure rollout and the maturity of contract conditions globally, but we expect WaaS to mature fast because students represent an interesting and

important market segment. We see increased interest among CIOs to adopt WaaS as a backup to campus Wi-Fi as WaaS becomes an accepted alternative.

Altogether, this means a steady move for WaaS through the Hype Cycle — almost midway between the Peak of Inflated Expectations and the Trough of Disillusionment. We also expect a rather quick journey — closer to five years than 10 — to the Plateau of Productivity, and possibly even a move in two to five years if more NRENs follow suit in acting as trusted brokers, and as 4G networks spread.

User Advice: Even if the adoption of WaaS is triggered by a need to provide large groups of students with cost-effective access to institution services, several other benefits can be achieved if the right contract is negotiated. They include ensuring increased bandwidth at the campus by allowing/petitioning the telco to set up access points. If designed in the right way, this will have a very positive impact on business continuity because it introduces another network that is completely independent of the campus network. (If this is combined with any other cloud services, such as email or PaaS/SaaS for administrative systems, then it further spreads the risk of total service breakdown.) A key issue for researchers and students who travel a lot is roaming costs. If the institution has remote or international locations, or affiliates that are expected to travel a lot, then a roaming tariff has to be included in the contract. Furthermore, because some services will still require high bandwidth that is not allowed or provided through mobile networks, the option of consolidating home and mobile Internet connections should be included in the contract negotiations.

Business Impact: The key business benefit is to provide real, ubiquitous access to institution services anytime, anywhere — and, in particular, to increase student transparency regarding the real cost for their education (which is required by law in some countries). Nontraditional students in particular (who are increasing in numbers) who need to combine work and family with studies need true mobile network access to be able to exploit all dead time (for example, commuting) and be more productive. However, this type of infrastructure as a service has an impact on the IT organization's ability to address business continuity, and, ultimately, to provide the IT organization with more sourcing options that allow it to focus its resources and skills on the services that require specific institutional knowledge.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: Janet (3G); Sprint

Recommended Reading: "Is Your WLAN Ready for the K-12 One-to-One Student Computer Initiative?"

802.11ac Wave 1

Analysis By: Tim Zimmerman

Definition: 802.11ac is a next-generation, higher-speed WLAN standard developed by the IEEE and ratified in January 2014. It will be implemented in two waves. Wave 1 implements four-channel bonding that improves performance to 1.3Gbps on 5GHz only.

Position and Adoption Speed Justification: We expect to see slow adoption in the market for Phase 1 of the standard on the basis of performance, because most mobile devices have only one or two antennas and devices may need eight antennas to achieve the higher performance. Additionally, many applications can achieve their business value with an existing 802.11n solution, which also operates at both 2.4GHz and 5GHz, whereas the benefits of 802.11ac are achieved only at 5GHz. Many clients adopting the new technology are doing so largely because there is little or no price difference from vendors between the faster 802.11ac solution and the current 802.11n radio. Multiple radio access points allow vendors to continue to address 2.4GHz with 802.11n. 802.11ac for 5GHz will provide backward compatibility, but mainstream announcements of 802.11ac Wave 2 will replace the need for Wave 1 solutions.

User Advice: Evaluate your usage scenario to understand your enterprise needs and whether they can be addressed by 802.11n. 802.11ac can be used as long as you're not paying a premium for unused functionality. Enterprises needing to address high-transaction, dense environments should wait for 802.11ac Wave 2, which will allow up to four simultaneous 1+ Gbps streams within the single coverage area of an access point.

Business Impact: 802.11ac Wave 1 will increase top-end throughput within a coverage area, which helps applications that require large file transfers, such as computer-aided design (CAD) drawings or high-definition data streams needed for telepresence or in-home entertainment. Business benefits will be delayed until most enterprise client devices utilizing the infrastructure are 5GHz capable, including tablets, laptops, smartphones and other network-connected devices (such as printers). Small and midsize businesses may not see the need to upgrade from 802.11n until their installed products reach their end of life.

Benefit Rating: Low

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: Aerohive; Aruba Networks; Cisco

Adaptive Learning

Analysis By: Jan-Martin Lowendahl

Definition: Adaptive learning in its fundamental form is a methodology that changes the pedagogical approach toward a student based on the student's input and a predefined response. Educators recognize this as instruction based on the student's success on previous levels of attainment. Adaptive learning more recently is being associated with a large-scale collection of learning data and statistically based pedagogical responses, and can be seen as a subset of personalized learning that includes such approaches as affective and somatic computing.

Position and Adoption Speed Justification: Adaptive learning is finally coming of age. The concept traces its roots back to at least the 1950s, but the increasing abilities of capturing learner data through online learning has meant a breakthrough. Companies such as Carnegie Learning and Knewton have been working to prove adaptive learning's viability. Knewton's approach to start its own online SAT training has especially proved valuable in collecting the empirical data needed to prove the value of this approach. But the real breakthrough was Knewton's "productification" of the concept into an "adaptive learning platform" because it represents a major step toward making "personalized learning" accessible. Anyone can buy Knewton's adaptive learning platform, and the adoption by large players such as Pearson's will likely ensure big enough datasets for enough topics for personalized learning to break the critical-mass barrier.

The real value of adaptive learning lies in the metadata attached to each learning "morsel." That is why we see open tools for tagging so that anyone can tag educational content, even open educational resources (OER), to the fine-grained level that is needed for true adaptive learning (a type of crowdsourcing and big data collection). That learning morsel must then be combined with enough empirical data of students trying to master the topic to give statistically valid "personalized learning." This capture and reuse of metadata is something that has to be managed by license agreements that allow vendors and OSS products to continuously improve their topic-based metadata so that it can feed directly back into adaptive learning. This is also one of the reasons we see projects like edX from MIT and Harvard. Empirically captured and statistically valid learning metadata is extremely valuable in designing the pedagogy of the future.

We are hitting the knee in the s-curve that could spell exponential growth of adaptive learning over the next decade of adaptive learning. The more educational institutions that sign up, the better adaptive learning becomes. The signs for adoption are good, and results are beginning to hit the community. For example; UNVL, ASU and U Alabama have all increased their pass rates for their math readiness courses with 19%, 11% and 17% respectively using adaptive learning.

The hype is still strong, and several new vendors are getting into the game with their own twists on adaptive learning. But there is also increasing questioning of the methodology behind some products. This proliferation of vendors creates some confusion and brings up the issue of metadata standards for collecting the large datasets needed and providing the student with a seamless transition between different adaptive learning platforms and content — a "portability-problem" that is similar to what we have seen in the e-portfolio case. We have entered a phase where usage of adaptive learning gives increasingly real-world experience on a broader scale that will give invaluable data and provide many lessons for optimizing the adaptive learning ecosystem.

This merits a clear move toward the Trough of Disillusionment as we gather more experience and enter a healthy debate on methodology, cost and benefits. Even though the benefits are obvious and the road map promising, with a potential snag of legal issues, we still believe that there will be another five to 10 years to the Plateau of Productivity and mainstream adoption in the best case.

User Advice: CIOs will play a major role in helping increase the degree of digitization (from infrastructure to textbook) to reach the level where all appropriate learning can be done digitally, allowing the adaptive learning tools to be applicable. But the key stakeholder will be faculty responsible for online learning because this tool can tip the scale in competitive advantage for

online programs — perhaps so much that pure brick-and-mortar programs need to care. A very practical advice is that CIOs, in collaboration with faculty, must make sure that adaptive learning requirements begin to be included in learning environment RFPs.

The key challenge for adaptive learning is to get large enough datasets that allow statistically valid personalized learning advice to the student. The question that looms is whether current license constructions for Knewton, for example, will hold up when institutions realize their student data is helping potential competitors. It is easy to see a walled-garden system where only the biggest institutions get real benefit from adaptive learning because they are the only ones that can reach a critical mass of data. Another related potential challenge is to which degree privacy regulation (laws) and student rejection of this tracking will impact the datasets that can be collected. Finally, it remains to be proven that adaptive learning platforms work with any topic, not just relatively structured topics such as SAT and college math readiness programs, which are behind its current success.

Business Impact: Adaptive learning has the potential to solve at least part of the biggest problem that faces education today: "cost-effective scalability with retained and preferably improved quality."

In general, adaptive learning is part of a larger set of approaches to further personalize the online educational experience. Another example is affective computing, which aims to achieve personalized learning based on, in particular, emotional sensory input. It is also related to context-aware computing in general.

The ultimate aim of adaptive learning in education is to enhance the learning experience of the student, which should result in tangible results such as higher grades, faster throughput and higher retention, preferably at lower cost to the student. A key accomplishment would be if adaptive learning enabled outcomes based on "any paced" learning. These results will benefit students, institutions and society.

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Blackboard; Carnegie Learning; Desire2Learn; Instructure; Knewton

MOOC

Analysis By: Jan-Martin Lowendahl; Marti Harris

Definition: The massive open online course (MOOC) is an online phenomenon originally made possible by: cloud-based social networking facilitation of acknowledged experts in a field of study; freely accessible online resources; and hundreds to thousands of registered students. MOOCs have free (no fee) open enrollment to anyone anywhere with network access. Students self-organize their participation in a MOOC.

Position and Adoption Speed Justification: MOOCs share some traditional course conventions, such as predefined course timelines and weekly topics, although the social element of self-organizing students is generally considered as one of the great new benefits of the MOOC model. New findings are being collected as MOOCs continue to develop and evolve. The 2013-to-2014 school year has seen an increase in university MOOC participation globally. However, during this period, questions about the MOOC business models have intensified, leading to experiments with fees and credit discussions that bring MOOCs toward more traditional higher education online offerings. We expect MOOC business models to continue to evolve to become more sustainable as more models are tested. For example, the MOOC is used in content delivery experiments, such as using it for flipped classroom pedagogy.

MOOCs also challenge traditional universities' business models, and institutions experiment with MOOCs in many ways — ranging from using it as a marketing tool to using it as a research tool to gather big data about how online teaching and learning works. Many studies about MOOC students, such as age, location and even financial need, are being undertaken to understand where MOOCs can play a role in the future education ecosystem. Examples of MOOCs include Coursera, Khan Academy, edX and Udemy. It is reasonable to assume there are additional MOOCs yet to gain full awareness within social networks.

The long-term success of MOOCs cannot yet be determined, but MOOCs are heading down to the Trough of Disillusionment as the community gets past the hype and gathers real experience about MOOCs. The next two years should deliver a more sustainable learning offering that will bring value to the education ecosystem, with or without the MOOC acronym.

MOOC is already transforming into several new online learning delivery models. Altogether, this merits a position for MOOC approximately halfway between the Peak of Inflated Expectations and the Trough of Disillusionment, but we also see it becoming obsolete before reaching the Plateau of Productivity, as we await the new forms this "technology" will take on in the Hype Cycle.

User Advice: To educators, MOOCs present challenges:

- View MOOCs as three opportunities: product (content), process (marketing and organizations) and platform (social collaborative learning platform).
- "Where's the money?" — Everything has a cost and a price tag. Will institutions of higher education support (pay) their faculty and in-house experts to offer MOOCs?
- Do MOOCs offer sustainable teaching or learning opportunity?

IT decision makers should:

- Enroll in a MOOC to gain insight into the phenomenon so they can join faculty and administrative MOOC discussions.
- Assess the IT cost to provide technical support in areas that may impact their institutions, especially in light of the lack of tuition and fees that are not collected for MOOC offerings.

- Determine if the current learning management system (LMS) provider is offering a MOOC model for pricing- and cloud-based single-course offerings. Most are making a positive movement toward matching MOOC opportunity and, in some cases, also are meeting the non-fee-based models.
- Monitor the MOOCs as they evolve in what we expect to be a branching manner as they move through the Hype Cycle before reaching the Plateau of Productivity. Other forms of social open online learning are expected to continue through the Hype Cycle but will not necessarily have the MOOC description. When this begins to happen in an institution, both newer and continued developments should be explored that will expand from an institution's original MOOC efforts.

Business Impact: MOOCs have helped put digital education on the agenda — even in the Cabinet of the U.S. But, we also anticipate that the original vision/definition of MOOCs will play a diminishing role in the future of education as MOOCs morph into new forms.

The business impact of MOOCs is changing as MOOC organizations strive to find a sustainable business model and address the cost of, for example, authentication and credit offerings. Economic and social drivers not only make the MOOC model a phenomenon that cannot be disregarded, but also force many institutions to rethink their existing business models. Established learning platform providers must address how to compete with a model not based on full-time equivalents, head counts and traditional license business models, if they plan to compete in the MOOC market.

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Coursera; EdX; Khan Academy; Udemy

Recommended Reading: "Higher Education Must Prepare for the Growing Influence of MOOCs"

Gamification

Analysis By: Brian Burke

Definition: Gamification is the use of game mechanics and experience design to digitally engage and motivate people to achieve their goals. Gartner has recently redefined gamification; in this new definition, it is distinguished by its digital engagement model and the focus on motivating players to achieve their goals (see "Redefine Gamification to Understand Its Opportunities and Limitations").

Position and Adoption Speed Justification: In the 2014 Hype Cycle, gamification has moved from the Peak of Inflated Expectations in 2013, to begin the entry into the Trough of Disillusionment today. According to Google Trends, over the past year, the hype surrounding gamification overall has leveled, and the number of critics of gamification is increasing. But client inquiries indicate the focus for gamification has clearly shifted from being primarily consumer-facing and marketing-driven, to becoming primarily an enterprise concern with a focus both internal and external to the organization. Internal to organizations, gamification is being used in recruiting, onboarding, training,

wellness, collaboration, performance, innovation, change management and sustainability. This trend is set to accelerate as larger vendors, such as salesforce.com, begin to integrate game mechanics and analytics into their software offerings. In addition to externally focused solutions targeting customers or communities of interest, there are also an increasing number of gamification solutions focusing on specific communities of interest, particularly in civic, health and innovation areas.

Gamification leaders such as Nike, Khan Academy and Quirky demonstrate that gamification can have a huge positive impact on engagement when applied in a suitable context. However, gamification has significant challenges to overcome before widespread success occurs. Designing a gamified solution is no easy task — successful solutions are focused on enabling players to achieve their goals. Player goals and organizational goals must be aligned, and only then can the organizational goals be achieved as a consequence of players achieving their goals. Successful gamified solutions design an experience for players that takes them on a journey to achieving their goals. Designing for engagement (rather than for efficiency) is a new skill, and one that is in short supply in IT organizations. This will hinder the development of the trend over the next three years.

User Advice: Gamification builds motivation into a digital engagement model, and can be used to add value to products and to deepen relationships by changing behaviors, developing skills or driving innovation. The target audiences for gamification are customers, employees and communities of interest.

Organizations planning to leverage gamification must clearly understand the goals of the target audience they intend to engage, how those goals align with organizational goals and how success will be measured.

Gamification technology comes in three forms:

- General-purpose gamification platforms delivered as SaaS that integrate with custom-developed and vendor-supplied applications
- Purpose-built solutions supplied by a vendor to support a specific usage (for example, innovation management or service desk performance)
- Purely custom implementations

Organizations must recognize that simply including game mechanics is not enough to realize the core benefits of gamification. Making gamified solutions sufficiently rewarding requires careful planning, design and implementation, with ongoing adjustments to keep users interested. Designing gamified solutions is unlike designing any other IT solution, and it requires a different design approach. Few people have gamification design skills, which remains a huge barrier to success in gamified solutions.

Organizations are beginning to use gamification as a means to motivate employees and customers. Implementing gamification means matching player goals to target business outcomes, in order to engage people on an emotional level, rather than on a transactional level.

Business Impact: Gamification can increase the effectiveness of an organization's digital business strategy. It provides a means of packaging motivation and delivering it digitally to add value to

products and relationships. While many of the concepts in gamification have been around for a long time, the advantage of a digital engagement model is that it scales to virtually any size, with very low incremental costs. Its use is relevant, for example, to marketing managers, product designers, customer service managers, financial managers and HR staff, whose aim is to bring about longer-lasting and more-meaningful interactions with customers, employees or the public.

Although gamification can be beneficial, it's important to design, plan and iterate on its use to avoid the negative business impacts of unintended consequences, such as behavioral side effects or gamification fatigue.

User engagement is at the heart of today's "always connected" culture. Incorporating game mechanics encourages desirable behaviors, which can, with the help of carefully planned scenarios and product strategies, increase user participation, improve product and brand loyalty, advance learning and understanding of a complex process, accelerate change adoption, and build lasting and valuable relationships with target audiences.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Badgeville; BigDoor; Bunchball; RedCritter

Recommended Reading: "Redefine Gamification to Understand Its Opportunities and Limitations"

"Technology Overview for Gamification Platforms"

"Business Model Games: Driving Business Model Innovation With Gamification"

"Gamification: Engagement Strategies for Business and IT"

"Best Practices for Harnessing Gamification's Potential in the Workplace"

"Gamification: The Serious Side of Games Can Make Work More Interesting"

Digital Preservation of Research Data

Analysis By: Jan-Martin Lowendahl

Definition: Digital preservation in the higher education community context refers to the issue of dealing with very long-term storage and retrieval of primarily research data. The objective of digital preservation is to attain or surpass the standard of archiving and retrieval that was set by handling paper archives for hundreds of years in some countries.

Position and Adoption Speed Justification: Although the problem has been around for some time, progress in this field has been rather slow due to the pace of change in IT, as well as the perceived high total cost of ownership (TCO) and a lack of monetary ROI. The strategies for addressing the problem are well-developed in theory, but the practical solutions have not been as

strong. This has now changed, thanks to the fast decrease in storage cost, as well as the emergence of alternative sourcing models, such as the cloud.

A breakthrough is the "trusted broker" approach that is the result of two major open-source software repository communities, Fedora Commons and DSpace Foundation, joining forces to create the DuraSpace organization and DuraCloud service. DuraCloud was officially launched in 2011. Its price list for its services shows costs based on options of storage capacity and the underlying choice of the public cloud provider.

The increasing maturity of the underlying cloud storage services, such as Amazon Web Services, Rackspace and San Diego Supercomputer Center storage, makes it highly likely that this service will deliver on its promise to overcome the TCO argument that previously haunted the issue. But the real long-term benefits lie elsewhere. The important death-of-distance effect helps research communities to come together in an unprecedented way to create critical mass for even small topic areas. The cloud delivery model also brings a disintermediation of the IT departments that, more often than not, speeds up the implementation. Finally, the retrieval of the data is greatly enhanced with the de facto user interface that software as a service (SaaS) inherently brings with it.

DuraSpace is maturing into a "preservation stack," enabling and integrating more services related to preservation. An example includes the development of the DSpaceDirect service, which is a hosted version sprung out of the experience of DuraCloud. The key issue is long-term, sustainable funding to keep development going while the business model is fine-tuned. Sponsorship funds are still the major source of revenue. We foresee that similar government-funded, cloud-based preservation/ open-access efforts will run into similar problems.

More clients test this type of SaaS, and trusted brokers, such as Internet2 Net+, vet this type of service, resulting in increased knowledge about what works and what doesn't. Altogether, this merits a relative jump well toward the Trough of Disillusionment this year, because technical and service bundling issues are being ironed out. We still stick to the estimate of five to 10 years until the Plateau of Productivity, because of the remaining main issues that will drive digital preservation into the Trough of Disillusionment — privacy, intellectual property rights and metadata. The latter will always be deeply embedded in the respective research areas, and likely a perpetual issue related to digital provenance and re-creation of data. To this, we add what we think is a short-term funding issue that is related to scaling up the services provided from a development and governance point of view. However, we believe this issue will be overcome over time as business/ funding models for these basically open-source efforts are developed, making the Time to Plateau closer to five than 10 years.

User Advice: Digital preservation is starting to get the attention it deserves. With increased dependence on digital data and more focus on open-access policies from funders, the principal relevance to research is increasing and even mandated in some cases. However, a key problem is still that funders do not yet provide the cash for the sometimes decades of storage that is implied in "open access." CIOs should inform researchers that they must include a request for funds for storage before they accept the "open access" policies imposed by funders. The increasing volumes of data and potential cost benefits in tiered storage will force institutions to adopt information storage and retrieval strategies that include the digital preservation of research data. The basic

strategies now have to include cloud storage options. However, it is important to conduct proper due diligence of external providers, including not only operational procedures and exit strategies, but also privacy and legal matters. This area is well-suited for shared services or cloud computing solutions due to the obvious economies of scale, even in due diligence. The cloud option in particular means setting up or finding a broker that is within the academic sphere of trust, such as DuraCloud.

Business Impact: Success in handling the digital preservation problem in higher education is crucial for future research, because more and more data exists only in the digital realm. In the long term, it has the potential to be transformational for research, especially for its ability to revisit raw data for new interpretations and to access very long series of data.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: DuraSpace

EA Frameworks

Analysis By: Cathleen E. Blanton

Definition: Enterprise architecture (EA) frameworks generally refer to a catalog of artifact types and the taxonomical structure for EA artifacts, and also imply a process for creating, using and governing those artifacts. This Hype Cycle entry focuses on the aggregation of hype concerning all EA frameworks that are offered in the marketplace for use by EA practitioners and EA programs. It does not focus on a single EA framework or the concept of an EA framework.

Position and Adoption Speed Justification: Gartner has observed less interest in evaluating EA frameworks from clients, as most clients have settled on a framework and are working on it and refining it, but a fair amount of confusion persists. While inquiries on frameworks have remained level, inquiries on specific frameworks have begun to decrease — for example, inquiries on TOGAF have decreased 40% from last year — and many of those inquiries focus not on framework selection, but on how to borrow from that framework to achieve business outcomes (see "Taming Your EA Framework With Business Outcomes"). In our 2011 global survey, 55% of EA programs recognized their use of an EA framework. Of those, 37% named "homemade" or "blended" as their primary frameworks, with no other public framework indicating greater than 10% adoption. A similar study conducted by Pennsylvania State University (http://ea.ist.psu.edu/documents/journal_feb2013_cameron_2.pdf) and published by the Association of Enterprise Architects in February 2013 found 54% of EAs chose a hybrid framework and more participants (37%) cited the architecture development process as the significant driver for selecting a framework.

We have advanced this closer to the trough to reflect the fact that most clients have passed the "pick a framework" panic and are evolving a personalized framework (that generally draws on EA and industry frameworks) that allows them to focus on delivering business outcomes. Clients will continue to evolve and customize their frameworks indefinitely as business challenges and EA

methodologies evolve, and as this evolution becomes accepted, the hype around the "one right framework" myth will further dissipate. We predict that, over the next three years, vendors and educational institutions will recognize the diminishing potential for competitive differentiation based on proprietary frameworks and the increasing emphasis on delivering outcomes and value.

User Advice: Our research indicates that EA frameworks are best viewed as inspirations to EA programs, rather than aspirations to be followed in exacting detail. Gartner recognizes that, while all EA functions can leverage process guidance and structural taxonomy from different EA frameworks, the proliferation of EA frameworks and the claims of their vociferous supporters have distracted EA from focusing on business outcomes (see "Enterprise Architecture Leaders Focus on Business Impact").

Our advice continues to be the following:

- Realize that any particular EA framework should provide a consistent organizing structure for architectural concepts, and should not simply be followed as a rigid process or set of rules.
- Review framework choices early in the EA process, leveraging existing EA team knowledge, and select characteristics that match the priorities of your enterprise, resonate with your stakeholders and facilitate decisions that deliver business outcomes.
- Assemble a quick, simple, expansible composite framework that can support high-priority EA activities — that is, those that will generate the most value and the best outcomes.
- Adopt constructs and taxonomy from industry frameworks such as BIAN and eTOM.
- Review and modify your framework periodically to ensure that it continues to meet your needs.

EA frameworks are a tool that complements intentional EA value planning, but cannot substitute for it. EA practitioners still must do the following:

- Focus the EA discipline first on delivering business outcomes that are based on business direction and future-state vision, as articulated in an enterprise context.
- Leverage multiple EA-related frameworks as inspiration and guidance for organizing, structuring and communicating architectural concepts specific to the organization.

Business Impact: The ongoing proliferation of EA frameworks and their surrounding hype reflect the desires of new consultancies and educational institutions to make a proprietary mark on the practice of EA throughout the marketplace. EA programs that are seeking a recognizable common language, process and artifact structure can refer to new frameworks, but should maintain focus on keeping their framework focused on outcomes and resonant with their industry and corporate culture. The market's tendency to introduce new frameworks is exacerbated by EA certification efforts that seem to equate an understanding or demonstrated prowess in a particular body of knowledge with proficiency in using one or more EA frameworks. Our observations and research indicate that the hype surrounding the term "EA frameworks" is more prevalent than interest levels from clients. We find that more organizations leverage components from multiple frameworks to develop a customized one that meets their business, IT and cultural needs, and resonates with their stakeholders.

Business leaders must focus their EA programs and their practitioners on pragmatic practices and outcome-driven deliverables that leverage the EA discipline to run, grow and transform their businesses.

Benefit Rating: Low

Market Penetration: More than 50% of target audience

Maturity: Early mainstream

Sample Vendors: Accenture; Atos; Capgemini; EA3 Cube; Enterprise Architecture Center of Excellence (EACOE); MIT; Sogeti; The Open Group; Zachman International

Recommended Reading: "Taming Your EA Framework With Business Outcomes"

"Enterprise Architecture Process and Framework; CIO Desk Reference Chapter 9, Updated Q4 2011"

"Gartner's 2011 Global Enterprise Architecture Survey: EA Frameworks Are Still Homemade and Hybrid"

Cloud Office Systems

Analysis By: Tom Austin

Definition: Cloud office systems include creative, collaborative, communication, social, coordination and data services, along with APIs that enable integration with other systems. (In the PC era, many of these were called "personal productivity tools.") Microsoft Office 365 and Google Apps for Business are examples. Most buyers start with a subset that includes email. The broad term "cloud office systems" is a generic label. The term "Microsoft Office" refers to a specific range of products from Microsoft.

Position and Adoption Speed Justification: Microsoft and Google have been investing heavily to attract enterprises to their cloud office systems. In addition, there are many other providers, some with a very broad suite (such as IBM's Smart Cloud for Social Business), and some with more narrowly defined, cloud-based subsystems that are relatively free-standing (such as Huddle) or that integrate with one of the very broad offerings (such as Fujitsu's RunMyProcess).

Cloud office system service providers often make hyperbolic claims of massive wins and enormous momentum but, as is the case in most Hype Cycles, actual penetration trails behind vendors' claims. As of 2Q14, only 10% of users (67 million) in the overall enterprise office market have moved to cloud office systems and most have focused on email, not the broad range of capabilities.

After slow growth from 2007 to 2013, cloud office system adoption is accelerating. It will reach 25% of the market's total potential by the end of 2017, 50% by 2020 and 90% by the market's 20th birthday in 2027.

We predict cloud office system providers will deliver socially savvy virtual personal assistants and other "smart" machine technologies, beginning in 2015 and 2016. (We do not expect market leaders to offer equivalent on-premises capabilities.) These capabilities offer great promise in terms of significantly enhancing employees' effectiveness (see "The IT Role in Helping High-Impact Performers Thrive"). If this prediction is correct, the "traditional" benefits and drawbacks of cloud office systems will become less important, but still deserve attention:

- Benefits include lower net cost (particularly for smaller enterprises); greater agility (via faster availability of new features); lower overheads (by replacing capital investment requirements with operating expenses, smoothing cash flow and cutting dedicated IT resources); easier provisioning; greater reliability and security (particularly for smaller organizations); improved user experience; and financial incentives from the service providers.
- Drawbacks include loss of control; risk of higher net cost in the long run; priority of other strategic initiatives (office systems have not been at the top of most IT organizations' strategic agendas for decades); compliance and regulatory concerns (which are slowly abating); difficult integration with on-premises systems; and functional deficits or surfeits.

User Advice: IT leaders should:

- Ignore self-serving vendor migration pressures.
- Where appropriate, run pilots of multiple cloud office systems that involve your internal customers, not just IT. Pit Google, Microsoft and others (such as IBM) against each other. For enterprises with 10,000 or more potential users, consider exploiting multiple vendors' offerings, if user subsets are cleanly separable. Avoid lock-in wherever possible.
- Avoid weak decisions. Look for evidence of dramatic improvements in user-job-related effectiveness or substantially tangible cost or risk reductions. "Shelfware" and "futureware" should not count. Fifty gigabytes of free storage are irrelevant if users need only two.
- Move if there is clear evidence of a need to, a strong sense of urgency and clear commitment. Otherwise, stay put for now — a move to cloud office systems may be financially irreversible. The larger the enterprise, the more difficult it will be to develop a sense of urgency, potentially leading to a loss of opportunity.

Business Impact: Our opinion of the benefits of cloud office systems has evolved over the past 12 months. If, as we expect, providers invest in high-value smart machine capabilities and deliver them only via their cloud-based offerings, cloud office systems could have a high to transformational impact on businesses. Otherwise, cloud office systems' business impact will be moderate to low.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Google; Hancom; Huddle; IBM; Microsoft; salesforce.com; Zoho

Recommended Reading: "The Cloud E-Mail and Collaboration Services Market"

"The IT Role in Helping High-Impact Performers Thrive"

"Top 10 Strategic Technologies — The Rise of Smart Machines"

"Predicts 2014: The Emerging Smart Machine Era"

"Google Apps for Business: Leading With Gmail"

"Explore Microsoft's Office 365 Plans and Suite Options Now in Advance of IT Operations Inquiries"

ITIL

Analysis By: Simon Mingay; Jan-Martin Lowendahl

Definition: ITIL is an IT service management framework. Originated by the U.K. government, ITIL is now owned by Axelos — a joint venture between the U.K. government and Capita. ITIL is structured as five core books to cover the full-service life cycle: service strategy, service design, service transition, service operation and continual service improvement. Specific implementation guidance is not provided — the goal is to offer a set of good practices that an organization should adapt to its needs.

Position and Adoption Speed Justification: ITIL has been evolving for more than 20 years. It is well-established as the de facto standard in service management. It shares many concepts and principles with the formal service management standard ISO/IEC 20000, although the alignment is not perfect, with differences reflecting the different origins and goals of the two bodies of work.

Axelos released a 2,000-question ITIL maturity self-assessment toolkit, but from Gartner analyst inquiry evidence, its takeup has not been extensive. The IT landscape is changing fast, but Axelos has not yet shown signs of an ability to keep pace; although Axelos' recent expansion may prove fruitful. Organizations with IT philosophies that are unchanged from 2011 (the last ITIL revision) will likely have deeply dissatisfied business customers — even where ITIL is the core guidance, continuous service delivery transformation is still a requirement.

ITIL has the highest adoption rate of the related frameworks used within IT operations (including COBIT, the Software Engineering Institute's Capability Maturity Model Integration [CMMI] and Microsoft Operations Framework [MOF]). Based on our polls, most organizations worldwide use the ITIL framework to some extent, but most also use additional sources of good practice, such as continuous delivery and lean.

Service transition and service operation are the most commonly used books and could arguably justify a higher position on the Plateau of Productivity. By contrast, service strategy has not gained momentum since the 2011 rewrite and so could be placed much earlier in the Hype Cycle. This unbalanced adoption is the reason that penetration is shown as 20% to 50%.

ITIL is widely adopted within educational institutions, even if the maturity of those implementations is often relatively low and the speed of progress similarly slower than we see in other sectors. This

relative slowness is a result of the cultural and behavioral challenges of the changes involved. ITIL skills are much sought after in the hiring process. Most early adopters in educational institutions have focused on implementing a basic level of "service desk" and "service support" capability, with processes such as change, incident and problem management in the first round. In this, they have gained valuable insight and a more realistic view of what ITIL can do for a higher education IT organization. More recently, we have seen many educational institutes implementing service catalogs and portfolios, but struggling to create something meaningful for the three very different constituents (faculty, administration and students). Still, full implementation of all ITIL processes in an institution is rare. Most educational bodies continue to treat ITIL as a bottom-up process engineering exercise and fail to put it in a more strategic and transformational context. We have positioned ITIL further back on the Hype Cycle for Education than we have for other sectors because it is applied in a less mature way. Expectations for IT service management (ITSM) in education have moved from a basic approach to ITIL, and now demand a much more strategic approach to transitioning to a true service-based organization. As the education sector increasingly looks at the exploitation of shared-service approaches, this lack of service management maturity will prove a stumbling block for many.

User Advice: Leverage ITIL as guidance to accelerate adoption of industry best practices, refined to meet the needs of your specific business goals. Some recent developments, such as the rise in agile methods and Pace-Layered Application Strategy, have yet to be explicitly reflected in the ITIL body of knowledge. While the core practices are sound, users currently need to look for additional inspiration in sources such as ValueOps, lean, DevOps and continuous integration if they are to keep up with changing operational needs.

Education institutions that are unfamiliar with ITIL should begin by examining the standard process framework used by ITIL. However, it is critical that they understand the true nature of the transformation to a service-based organization and develop a program in that context, rather than simply doing some bottom-up process engineering.

It is also important to recognize that most higher education institutions neither have, nor need to have, the cultural prerequisites for attaining the highest levels of service management maturity. However, for any educational institutions embarking on the creation of a shared-service organization, it is critical to develop the service management capability and tackle some of the underlying behavioral issues.

Business Impact: Large or complex institutions will likely find greater ROI because of: (1) the relative need for transparency through agreed-on processes and nomenclature due to many or different stakeholders; and (2) the relative return on the "administrative" overhead that ITIL introduces. ITIL is particularly relevant to central IT operational services groups (such as service desks, data centers and campuswide networks). ITIL also has a positive impact on multisourcing, where institutions and external service providers work according to ITIL.

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Recommended Reading: "ITIL 2011 Service Strategy: An Important Missing Link Between IT and Business"

"Five Ways to Manage IT Service Transitions to Cloud, Leveraging ITIL Processes and ITOM Tools"

"Use Six Sigma With ITIL 2011 to Improve IT Operations Processes and Effectively Leverage the Cloud"

"How to Leverage ITIL 2011 and Avoid Three Common Cost Traps"

"Increase I&O Effectiveness With the ValueOps Perspective"

"Running IT Like a Business 2.0: The Service-Optimizing IT Delivery Model"

BYOD Strategy

Analysis By: Jan-Martin Lowendahl; Bill Rust

Definition: BYOD, or "bring your own device," is set to become a dominant practice in higher education in developed countries and is growing worldwide. BYOD in this context means BYOD as a *deliberate strategy*, as opposed to the "provide a standard device strategy" that has been popular in the past. A BYOD strategy is *not* a "laissez faire" approach, but a thought-out, defined strategy. BYOD presents IT organizations in education with multiple challenges, but also provides multiple benefits.

Position and Adoption Speed Justification: CIOs in higher education or K-12 can no longer stop the wave of different consumer devices (not even among administrators). Moreover, the solution is not handing out "monocultures" (such as iPhones and iPads) — students revolt against that practice, preferring to use devices that they personally select. There is a need in education to formally adopt BYOD as a full strategy and to willingly support and advocate the BYOD approach as a benefit for the students and the institution. More institutions are moving toward this approach; others have not yet adopted it, but almost all institutions are discussing how to handle it. Educators in K-12 must address equity as an issue, especially where the electronic delivery of instruction is required — not optional. In higher education, the BYOD discussion is widening to include "bring your own everything" (BYOE), which includes devices as well as services. This relates closely to the Gartner term "consumerization" and puts even greater strain on the IT department. BYOD is here to stay. Real-world experience starts to accumulate and CIOs are scrambling to keep up as the BYOD strategy is sliding toward the Trough of Disillusionment. However, we anticipate rapid advancement through the Hype Cycle as pressure from students and faculty builds.

User Advice: For IT organizations to take advantage of the BYOD trend, the security of the network and applications must be first-rate. Moreover, the systems that the customers interface with must be capable of transacting business in all of the major devices and OSs, *or* the mobility strategy must be built around a common denominator protocol like HTML5. The situation is similar to that of SMS or texting: Texting is ubiquitous because it is device-, network- and OS-neutral. It works

virtually everywhere on most phones, smartphones and many handheld devices. It may not be "pretty," but it is effective.

A mobility strategy for BYOD must be the same. It must work with almost any device that has a browser in order to be acceptable. The alternative is to program the front end of many systems in iOS, Android or other mobile OSs, which is an expensive proposition and a losing battle. Accommodating at least each major handheld OS would allow for the maximization of the user experience, but using a browser-based technology, while not the "prettiest" option for each device, is ubiquitous and allows generalized mobility. The multi-OS problem is accentuated in education because students can be expected to bring a much more varied set of devices compared with a corporate environment, and at the same time, guiding by policy is more difficult. Still, it is becoming common for an institution to offer a few OS-specific and optimized apps for specific purposes — for example, GPS-enabled campus maps. However, these are commonly purchased through vendors such as Blackboard, Sourcebits and Modo Labs.

With such approaches as a virtualized desktop (cloud desktop) and the use of the functionality of server-based computing such as Citrix, even devices of relatively limited native functionality can be effectively utilized by various constituencies. However, it may be necessary, in the case of some specific applications, to maintain a relatively small application group to build campus- and institution-specific applications that are offered through the campus's own app store — for free or for a price. This approach could be used to effectively provide optional but desired services via a self-supporting financial model.

Business Impact: With the acceptance of the consumerization of technology and the near-universal acceptance of the use of personal devices to access and interact with enterprise systems, IT directors are embracing the trend of pushing transaction processing to the users — to their delight (thereby making a virtue out of a necessity). It is a reversal of the 40-year trend of IT organizations having to maintain all tools for collecting and processing data, but it is a key step toward embracing an exostructure strategy (see "Gaining Competitive Advantage in the Education Ecosystem Requires Going Beyond Mere Infrastructure to Exostructure").

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Blackboard; Modo Labs; Sourcebits

Recommended Reading: "BYOD in Education by Design, Not Default"

"The Impact of BYOC on Management and Support"

"How to Create a Bring-Your-Own-Device Policy"

Open-Source Middleware Suites

Analysis By: Jan-Martin Lowendahl

Definition: An open-source higher education middleware suite is defined as a collection of middleware needed to integrate software solutions on campus. It includes functionality such as identity and access management, enterprise service bus, and workflow.

Position and Adoption Speed Justification: A plug-and-play software integration foundation is something that institutions have strived for decades to achieve, leading to many more-or-less trendy approaches, of which service-oriented architecture (SOA) is the current dominant incarnation. Alongside commercial "closed source" options for the components of an SOA platform, the higher education community has run several high-profile open-source software (OSS) projects, of which the Jasig uPortal (now part of Apereo) and the National Science Foundation (NSF) middleware project have been among the most visible. Both projects have affected the market in a positive way. The Jasig uPortal did it mainly through "pushing" the adoption of Web services standards and by providing a neutral service delivery platform for vendors such as SunGard Higher Education (now Ellucian). The NSF middleware project produced the Federated Identity and Access Management (FIAM) solution, Shibboleth, which is used by the majority of identity federations in the academic world.

These single-purpose middleware OSS projects have now been complemented by an OSS middleware suite approach that has its roots in the community source foundation models represented by Sakai and Kuali. Both foundations decided early on to have an SOA design approach, and consequently, a number of middleware components have become crucial to their success — especially in the case of Kuali, where the seamless integration of a number of administrative applications is a major goal. It is, therefore, only a natural consequence of these needs, together with the Kuali Foundation's knack for marketing, that we saw the first release of the OSS higher education middleware package named Kuali Rice in 2009.

Kuali Rice is composed of several modules, such as identity management, enterprise workflow, enterprise service bus, enterprise notification and an application development framework. The aggregation approach of several existing components, together with the community source model, merits a rather fast time to plateau on the Hype Cycle. However, the complexity of middleware in itself adds a certain level of uncertainty to the project as well. A recent example is that the Kuali Rice project bet on the object-relational mapping (ORM) framework Apache ObJectRelationalBridge (OJB) early on, rather than Hibernate. OJB was retired in 2011, while Hibernate has been folded under JBoss and is the thriving community for ORM functionality. This has resulted in a relatively extensive redesign and rewrite of some parts of Kuali Rice. Nevertheless, these problems are solvable, and the project has made steady progress. A sign of its relative maturity is that a few institutions, such as Ohio State University, have adopted Kuali Rice without any plans to use any other Kuali components. The 2.4 version of Kuali Rice that was originally due in November 2013 was finally released in April 2014, showing that redesign is hard, but that the community has good staying power.

There is one cloud on the horizon, though, and it is the strong interest in cloud computing by the higher education community. Going to the cloud partly requires different sets of technologies and

skills that are more outward-facing (see "Gaining Competitive Advantage in the Education Ecosystem Requires Going Beyond Mere Infrastructure to Exostructure"). This means that the focus might be shifted to efforts such as OpenStack (www.openstack.org) if the Kuali Rice project fails to include cloud integration functionality.

This merits slower progression and a position just past the Trough of Disillusionment as the community evaluates this new major release. Considering the cloud developments and the always looming issue of choosing the right OSS tool mentioned previously, institutions should be aware that there is a non-negligible risk that Kuali Rice can be obsolete before plateau. However, in that case, institutions will need a replacement that enables them to realize the same functionality.

User Advice: Middleware can be a complex business that requires careful design consideration. The simple fact that it sits in the middle of a lot of information streams makes it hard to replace, and these solutions tend to be long-lived. Therefore, it is crucial to choose solutions that are as flexible as possible by adhering to standards (open as well as de facto) that are as future-safe as they can be. OSS projects have a good track record in implementing open standards, and as demonstrated, they can even drive standards adoption. Therefore, open-source higher education middleware suites should at least be on shortlists when compared with commercial options to test vendor openness. However, Kuali Rice is not the only OSS project with an SOA aim. There are a few less-marketed alternatives, such as the OKI Bus (see "Case Study: Approaching the Learning Stack: The Third-Generation LMS at Universitat Oberta de Catalunya") and more traditional OSS projects supported by vendors such as MuleSoft and Talend.

Business Impact: Kuali Rice is still in its early days compared with older and more complete suites from vendors such as Oracle and IBM. However, the characteristics in terms of more-general functionality and global need for middleware relative to, for example, learning management systems or enterprise resource planning platforms, make it a good candidate for the sustainable global OSS community. At the very least, this OSS project can help push open standards, which can be a foundation for a plug-and-play Web services approach that will promote the coexistence of many delivery modes, as well as business models, with an open and objective platform.

There is already a precedent for creating a common platform, or at least a reference platform, the way Shibboleth did in working together with the Liberty Alliance to influence the development of the SAML 2.0 standard.

An added benefit of the OSS middleware suite is its relatively lightweight approach to middleware compared with commercial options. The lightweight nature, combined with the lack of upfront investments, allows institutions to start implementing more quickly and gain maturity in a crucial institutional capability.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: Kuali Foundation; MuleSoft; Talend

Recommended Reading: "Open Source in Higher Education, 2008"

"OSS Administrative Solutions in Higher Education Are Becoming More Viable"

"Overview of Kuali Administrative OSS Offerings for Higher Education"

"Case Study: Approaching the Learning Stack: The Third-Generation LMS at Universitat Oberta de Catalunya"

"Gaining Competitive Advantage in the Education Ecosystem Requires Going Beyond Mere Infrastructure to Exostructure"

"Who's Who Among Providers of Enterprise Service Bus Open-Source Software"

Cloud HPC/CaaS

Analysis By: Jan-Martin Lowendahl

Definition: Computing as a service (CaaS) or cloud high-performance computing (HPC) in higher education deals primarily with on-demand delivery of moderate to massive computing power for education and/or research purposes.

Position and Adoption Speed Justification: Cloud HPC or CaaS is a natural extension of grid computing for many higher education institutions, and some grid computing implementations border on the concept of the "private cloud" even today. Many institutions also collaborate in the HPC area and have already established "shared-service HPC." This means that cultural acceptance of CaaS will likely be high. Further advantages include the classic "cloudonomics," such as electricity and cooling savings, pay as you go, and rightsizing, countered by the usual drawbacks regarding intellectual property (IP) protection, privacy, backup and so on. The most interesting effect is how cloud HPC/CaaS is increasing the availability of HPC to smaller institutions and even to students. The interest is at a high level, and several institutions are including cloud HPC in particular in their sourcing strategies.

Cloud HPC/CaaS has moved beyond proof of concept and entered the next phase, focusing on establishing practical processes and services on a larger scale. For example, established grid organizations, such as the European Grid Infrastructure (EGI), are transforming existing grids into "cloud computing" through the EGI Federated Cloud Task Force. Even more interesting, the Helix Nebula initiative (www.helix-nebula.eu) is a step toward a European cloud-based scientific "e-infrastructure," which aims to bring together several providers — commercial and public — to create a viable competitive market of cloud services. Several well-known organizations and vendors are involved, such as CERN (the European Organization for Nuclear Research), the European Space Agency, BT Global Services, Atos and Capgemini. Even commercial players — such as UberCloud, which helps academics find suitable cloud HPC services — have entered the market. Privacy-related concerns, such as the Edward Snowden-National Security Agency incident, have delayed some of these cloud efforts, but there is still a steady path to maturity, and cloud HPC/CaaS is at least on the shortlist for institutions seeking to increase their computing capacity.

Cloud HPC/CaaS is just past the Trough of Disillusionment but not quite into the Slope of Enlightenment. Problems are now being ironed out, and practical experience separates hype from reality. We expect a relative jump into the Slope of Enlightenment in 2015.

User Advice: To move to cloud HPC/CaaS, institutions must understand their current total cost of ownership and risk level, and they must conduct due diligence to check up on the intended provider (regardless of whether it is a nonprofit shared-service consortium or a commercial vendor) on issues such as IP, privacy, security, storage and backup. The data-loss incident, from services such as Dedoose, shows that due diligence and a good contract with appropriate penal clauses are crucial best practices for any kind of external sourcing. Considering the increased awareness of privacy issues, it is advisable that the education CIO make sure key stakeholders and users are well-informed before starting to use these services. Cloud HPC/CaaS options are most valuable for institutions that face special circumstances, such as short-term projects, variable computing demands and limitations in power grids (as in downtown London). Institutions that are involved in cloud HPC/CaaS often, but not always, need to combine it with storage as a service. One capability that will likely rise in importance with cloud HPC/CaaS is network technology, which reduces latency and improves security. Another change for some institutions is that they have to factor in the bandwidth costs explicitly because many commercial services charge directly for that component, which has been "no fee" at the end-user level in most countries with an established National Research and Education Network.

Business Impact: The impact on higher education is potentially transformational because cloud HPC/CaaS puts more computing power in the hands of more students and researchers. Furthermore, it can act as a democratization force for institutions globally. The convenience factor is high and will probably lead to increased collaboration regarding computing-intensive research and education. If cloud HPC/CaaS can also be combined with subject-specific services, such as Gaussian as a service (for molecular calculations), and support from parallelization expertise for optimizing the code for the cloud, then it has the potential to speed up research cycles and tremendously increase accessible data volumes.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Amazon; Dell; Google; IBM; Microsoft; Obsidian Strategies

Open-Source Financials

Analysis By: Terri-Lynn B. Thayer

Definition: Open-source K-12 and higher education financial applications are developed via open-source or community source models.

Position and Adoption Speed Justification: Open-source solution financial projects have the potential to be part of a nonproprietary education administrative application suite or a best-of-breed financial solution.

Focus School Software provides open-source software for the K-12 market. Focus School supports more than 650,000 students, with Florida school districts representing the vast majority of users. Founded in 2006, more than half of Focus School's implementations have been completed in the last two years. Their primary offering is a student information system, but ERP modules for HR and finance were released in 2012 and 2013. Finance functionality includes general ledger, budgeting, fixed assets, purchasing and accounts receivable. Focus School Software is the sole provider of implementation services. A key value is their support for state reporting requirements in Florida, with recently added support for New Jersey and Texas.

The 10-year-old Kuali Foundation released their flagship Kuali Financial System (KFS) for higher education in 2007. Kuali is now implemented at more than 20 institutions of varied size and complexity, with one-third of those implementations completed in the last 18 months. The product functionality currently includes core financials and support for key higher education business processes, such as effort certification and endowment management. Anticipated new functionality includes support for travel and entertainment expenses as well as grant and contract billing.

The Kuali Foundation's initiative to partner and grow an ecosystem of a dozen for-profit vendors that can offer support to the development effort, as well as provide sustainable and professional support services and even hosting options, has matured and is key to future adoption. However, as the product ages, the foundation is beginning to grapple with the common issues of product renewal. To that end, the foundation has funded a project to upgrade the Kuali user interface (UI), while at the same time, several of the vendor partners are also providing alternative UIs. This is an interesting development that is a sign of interest in the products — but could also serve to splinter the still-fledgling community.

The community source software movement continues to mature, albeit slowly. While Focus School Software is the sole supporter of Focus School, the commercial-support ecosystem is expanding for Kuali. Both models are potentially sustainable, yet there are distinct advantages and risks to each approach. The growing number of module offerings for both Focus School and Kuali are expected to draw further interest. We no longer anticipate an implementation failure or other catastrophic event, so open-source software (OSS) financials has moved past the Trough of Disillusionment. However, while the interest continues, the total number of implementations is still very small, and is predicted to grow at only a moderate pace. Significantly increased adoption will be required for OSS financials to continue progress up the Slope of Enlightenment.

User Advice: Open-source financial solutions have moved to an adolescent stage, and should be monitored as a possible fit either for institutions that are capable of supporting in-house application development, or for those that can implement and operate with minimal changes and vendor support or hosting. With this large and complex OSS undertaking, it had previously been critical that institutions possess an OSS culture of software development and maintenance experience to keep risk levels under control. With the now-available vendor implementation and hosting options, this in-house development skill is no longer needed; but this also changes significantly the total cost of

ownership (TCO) and reminds us that although OSS can be an economical alternative, it is decidedly not "free."

Institutions outside the U.S. should observe how national regulation and local accounting best practices affect the need for customization and maintenance. Smaller institutions and institutions outside the U.S. that are contemplating an OSS financial solution should watch for signs of a maturing and even competitive market for commercial-support providers.

Business Impact: Financial administration and financial integration with other administrative applications will be affected by open source, but, as a whole, open-source financials will have a limited effect on the core mission of the institution's education and research. The main factor in adoption of open-source financials to date has been the reduced TCO vis-a-vis a commercial offering, and the vendor independence that the solutions offer. However, the benefits may increase if the finance module is implemented as part of a larger suite of integrated open-source solutions — achievable with both Kuali and Focus School. Hosted suite implementations will increase the opportunities for reducing on-premises technology, facilitating staff reallocation.

Benefit Rating: Moderate

Market Penetration: Less than 1% of target audience

Maturity: Adolescent

Sample Vendors: Focus School Software; Kuali Foundation

Recommended Reading: "Higher Education Sourcing Survey 2012: Increasing Interest in OSS and Cloud"

Mobile Learning Smartphones

Analysis By: Jan-Martin Lowendahl; Nick Jones

Definition: Mobile learning (m-learning) using smartphones is about handsets with an identifiable OS that is capable of supporting installable applications, such as iOS, Windows 8 and Android devices. M-learning encompasses a very broad range of applications, including — but not limited to — media delivery (for example, audio and video), exploratory learning using augmented reality, educational games, collaboration and project work, e-books, surveys, tests, data gathering, real-time feedback, and simulations.

Position and Adoption Speed Justification: Overall mobile phone sales rose to 1.81 billion in 2013 — up from 1.75 billion in 2012. Also, annual smartphone sales exceeded feature phones for the first time in 2013, but remained under 1 billion unit sales, reaching only 967.8 million units. Smartphones are already sufficiently capable and numerous in some markets as viable m-learning tools, even if tablets in different formats are often the preferred m-learning tool for official m-learning programs. A form factor versus function competition will segment the m-learning market more in the future. For example, some K-12 teachers reject smaller-screen-size phones for reading, while other institutions

embrace smartphones as replacements for "clickers" (classroom response systems) because of their size.

Technology-aided learning is drawing attention from investors, and a wide range of m-learning applications have been demonstrated. However, the domain is maturing surprisingly slowly to understand what type of education is best delivered on mobile devices, and how to integrate m-learning with traditional education. At present, m-learning through smartphones seems better suited for consumer markets than traditional education. In fact, mobile learning on low-range/midrange handsets has, in a way, had a much clearer trajectory of growth with its low-end (but ubiquitous) feature set that includes SMS and ringtone language lessons. Through 2015, emerging smartphone applications (such as augmented reality viewers, smartphone e-book reader applications and scriptable mapping tools) will offer new delivery platforms for educational content. In the long term, technologies such as flexible screens will enable a wider range of portable m-learning devices.

Inhibitors in 2014 still include the smartphone cost, device limitations (such as battery life), development of m-learning course materials, lack of skills and the wide diversity of mobile devices. Educause student data from 2013 shows that 76% of undergraduate students in the U.S. had smartphones. That is still a major inhibitor to any large curriculum changes based on the availability of smartphones, because schools still have to include a strategy for providing smartphones to all students.

Through 2014, we expect that platform differences will impact m-learning delivery technologies on smartphones. For example, technology-neutral content delivery tools, such as HTML5, may not have matured enough. Certain types of innovative applications may evolve more quickly on more-open platforms (such as Android), which impose fewer technical and commercial restrictions on developers.

Higher education system providers for administrative and learning systems are increasingly offering mobile applications, which is evidence of their financial commitment to meet the requirements of end users in higher education institutions. Android, iPhone and iPad applications from higher education providers are increasingly expected to be the norm. However, most of these applications are more geared toward administrative or course management tasks than actual m-learning.

Altogether, this merits a position that is just past the Trough of Disillusionment as the smartphone m-learning application (and market) finds its form as just another device to increase access to learning services, rather than as a killer device specific to formal education. With this redefinition of the market, we expect m-learning smartphones to reach the Plateau of Productivity within five years.

User Advice: Many educational institutions have experimented successfully with some form of m-learning. Educators should look for simple applications that can deliver educational materials or assist staff members and students with administrative tasks, such as sending assignment reminders and booking resources (for example, projectors). Educational institutions have the opportunity to increase the accessibility of learning content that better supports problem-based pedagogy, and also leads to better usage of "dead time" (for example, while commuting). The latter convenience is greatly appreciated by part-time learners, which tends to increase student satisfaction and retention.

The growing body of experiences has shown that, in some cases, the m-learning experiment initiatives have not been properly structured to truly assess the impact of devices such as smartphones. Failing to structure the experiments in m-learning leaves open the questions of the value and effectiveness of specific approaches to m-learning. Any institution attempting to experiment with m-learning should, therefore, carefully design the assessment phase to confirm or disprove the assumed advantages to specific applications of m-learning.

Business Impact: Corporations and governments should explore the potential of m-learning for just-in-time training. Organizations and educational institutions that create or sell training and reference materials should explore the potential of mobile devices as delivery channels.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Apple; Blackboard; Desire2Learn; Instructure; Tribal Software

Recommended Reading: "M-Learning Opportunities and Applications"

"Market Insight: Worldwide Opportunities for Consumer Mobile Applications in Education and Learning"

"Forecast: Mobile Phones, Worldwide, 2011-2017, 1Q13 Update"

"Market Share Analysis: Mobile Phones, Worldwide, 4Q13 and 2013"

"Best Practices for Mobile Device Learning Initiatives in Higher Education"

Social Learning Platform for Education

Analysis By: Jan-Martin Lowendahl; Marti Harris

Definition: A social learning platform is an extension of traditional systems for learning management and learning content management that incorporates social software features to support structured social and informal, as well as formal, learning activities. The platform supports learners' desire to receive learning as needed. Newer models include massive open online course (MOOC) platforms.

Position and Adoption Speed Justification: As awareness of the impact of informal and structured social situations on learning grows, students, faculty members and researchers are expecting social software features to support collaborative learning environments. Vendors are adopting product development strategies that are social-learner-centric, while educational institutions are exploring how best to use new social software options. Social learning platforms are still emerging, and expectations are still high, but not quite met. Educational institutions are reviewing their current learning environments to tap into the collective knowledge of all members of their communities and to increase their organization's capacity to learn formally and informally. They

also acknowledge the importance of social networks and the requirement to access the expertise of colleagues inside and outside the institutions. A social learning platform is particularly useful and engaging for students in hybrid or distance learning classes.

The experience from MOOCs shows the importance of "social" in learning platforms and is influencing the acceptance of social learning platforms. However, a significant number of faculty and students prefer to use open social platforms such as Google Sites or Facebook to complement traditional learning management systems (LMSs) rather than the now built-in social features in the learning platforms. This merits a position just past the Trough of Disillusionment because vendors and institutions are still trying to figure out the perfect mix in the learning stack.

User Advice: Institutions that have a single-purpose learning system installed should engage with their current vendors to understand the product development road map for enhancing systems with social software features. If their current vendors do not have plans for adding these features, or if the time frame for development is too long, then institutions should look for solutions that can be easily integrated into their learning stack. Solutions already in place, such as content management, collaboration and communication, should be considered for use, as well as solutions procured specifically for learning purposes. If student and faculty usage patterns show successful use of external (consumer) tools or services, then those should be considered for inclusion in the learning stack. Educational institutions that do not have systems for learning and content management, or that are looking to consolidate multiple learning applications, should add support for a social learning platform as an important evaluation criterion.

Business Impact: The social learning platform gives learners the ability to establish a presence or social profile that reflects their expertise and interest; to create, discuss, share and capture learning content as learning objects; to organize and find learning objects from a variety of sources, such as search or peer ratings; to interact with peers in their social networks and be able to reach beyond their networks to other trusted sources of information; to engage in experience-based learning exercises; and to receive real-time online coaching and support.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Blackboard; Coursera; Desire2Learn; edX; Google; Instructure; Microsoft; Moodle; Pearson (LearningStudio); Sakai

Recommended Reading: "Higher Education Must Prepare for the Growing Influence of MOOCs"

Climbing the Slope

Emergency/Mass Notification Services

Analysis By: Roberta J. Witty

Definition: EMNS automates the distribution and management of notification messages to an organization's interested parties (e.g., workforces, customers, students and citizens) through multiple endpoints (e.g., voice, email, SMS, digital signage, safety systems, public alerting systems and so on). Message distribution can be done via a Web portal, a mobile device app or browser, interactive voice response, or the vendor's call center. Use cases include emergency events, business operations notifications, IT service alerting and public safety.

Position and Adoption Speed Justification: Organizations are increasingly implementing EMNS to build stronger crisis management programs. Communication is critical during incidents ranging from localized events, such as a fire or power outage, to regional and catastrophic disasters, such as earthquakes (as in Chile, Haiti and Japan); hurricanes/tsunamis (as in Hurricane Sandy in the U.S., as well as the storms in Indonesia and Japan); terrorist attacks (as in Mumbai, India; in London; and in the U.S. on Sept. 11); and other business disruptions (as in the 2014 Bangkok Shutdown, the 2010 Iceland volcanic ash disrupting air travel, and the 2009 to 2010 H1N1 pandemic). The EMNS market is price-competitive at the basic capabilities level. As customer needs and use cases change and expand, so, too, will this market. The majority of implementations are hosted by the vendor and priced using a per-contact model.

EMNS products have attracted many specialty audiences, resulting in a large field of many small vendors and a few large multiproduct vendors. Gartner's current list contains more than 60 vendors. Consolidation is expected and needed over the next five years. Potential EMNS mergers and acquisitions include vendors in the following markets: facilities management; physical security; fire safety; crisis management; environmental, health and safety; disaster event information analytics/ situational awareness; and business continuity management planning.

No vendor has an offering that supports all use cases. There is some vendor overlap between the EMNS and communications-enabled business process markets (see "Hype Cycle for Unified Communications and Collaboration, 2013") through an EMNS product application programming interface for integration to a triggering business application. We are also seeing purpose-built offerings, such as customer communications management (see "Hype Cycle for P&C Insurance, 2013") and multichannel marketing communications (see "Magic Quadrant for Multichannel Campaign Management"). We expect that organizations will continue to need multiple tools to achieve all use cases.

Innovation in EMNS will come from expanded support for mobile devices as well as crisis/incident management situational awareness.

The position for EMNS in 2014 remains the same as in 2013 for the following reasons:

- The number of vendors is still expanding.
- The direction of new features is still open to interpretation — a few vendors are moving into the situational awareness market, but the adoption of these tools for that purpose has barely been embraced by the customer base.
- The use cases within the organization are expanding, and EMNS product capabilities are expanding in support of them.

User Advice:

1. Understand all the notification use cases needed by your organization to ensure that you are making the best use of your investment.
2. Use the same pricing model across all vendors on your shortlist to do a valid pricing comparison; this may require a vendor to convert its pricing model to yours.
3. Choose a vendor that has experience in your vertical industry to better align its offering to your business operations.
4. Choose an EMNS vendor that has customer support services located in the same or adjacent time zones as yours, and that also has language support for your operating locations.
5. Choose an EMNS vendor that has data center operations located in different geographic locations from yours; this is not only to prevent the same event from impacting you and the EMNS vendor, but also for privacy protection considerations.
6. Select an EMNS vendor that supports your organization's mobile technology and social media integration strategy, and that has device-specific applications that align with that strategy.
7. Carefully plan your workforce enrollment procedure to ensure that all people who need to be contacted are included in the service, and that their contact information is current and complete.
8. Carefully plan the type, number and content of notification messages, because:
    - Recipients of notification messages may ignore them if too many are sent about the same event.
    - Carrier-based character restrictions on text messaging make the formation of a meaningful message challenging.
    - During a regional disaster, you shouldn't overload the telecommunications infrastructure with needless messages.

Business Impact: The interest in and need for EMNS — which are critical for managing and improving an organization's crisis communications capability — continue to grow among governments, public and private enterprises (regulated or not), educational institutions, and operators of critical infrastructures, because crisis communications are becoming a best practice and a requirement for some industries (for example, higher education and part of U.S. fire code NFPA 72). The business benefits of using an EMNS tool include:

- Key personnel can be notified in minutes, and large numbers of nonkey, but affected, personnel can receive critical information about the event.
- Management can focus on critical decision making and exception handling, instead of message delivery.
- Human error, misinformation, rumors, emotions and distractions — which are so often present during a crisis — can be better managed and corrected.

- A documented notification audit log can be provided for real-time and postevent management.
- The reputation of the organization can be preserved/enhanced.

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: Amcom Software; AtHoc; Blackboard; Cassidian Communications; Eaton; Emergency Communications Network; Everbridge; Facebook; Federal Signal; FirstCall; Global AlertLink; MessageNet; MIR3; Omnilert; Rave Mobile Safety; salesforce.com (Chatter); Send Word Now; Sungard Availability Services; TapShield; Twenty First Century Communications; Twitter; Volo; xMatters; Yammer

Recommended Reading: "Magic Quadrant for U.S. Emergency/Mass Notification Services"

"The Emergency or Mass Notification Service Market: Now and for the Next Five Years"

"Spam Filters Could Cripple Your Emergency Notification System"

Hosted Virtual Desktops

Analysis By: Mark A. Margevicius; Nathan Hill

Definition: A hosted virtual desktop (HVD) is a full, thick-client user environment run as a virtual machine (VM) on a server and accessed remotely. HVD implementations comprise server virtualization software to host desktop software (as a server workload), brokering/session management software to connect users to their desktop environments, and tools for managing the provisioning and maintenance (for example, updates and patches) of the virtual desktop software stack.

Position and Adoption Speed Justification: An HVD involves the use of server virtualization to support the disaggregation of a thick-client desktop stack that can be accessed remotely by its user. By combining server virtualization software with a brokering/session manager that connects users to their desktop instances (that is, the OS, applications and data), enterprises can centralize and secure user data and applications, and manage personalized desktop instances centrally. Because only the presentation layer is sent to the accessing device, a thin-client terminal can be used. For most early adopters, the appeal of HVDs has been the ability to thin the accessing device without significant re-engineering at the application level (sometimes required for server-based computing).

While customers implementing HVDs cite many reasons for deployments, several important factors have contributed to the increased focus on HVD: the desire to implement new client computing capabilities in conjunction with Windows 7 migrations; the desire for bring your own device (BYOD) and device choice (particularly iPads); the need to deliver on business continuity requirements; and the uptick in customers focused on security and compliance issues. During the past few years, the

adoption of virtual infrastructures in enterprise data centers has increased, making HVDs easier to deploy. With this increase comes a level of maturity and an understanding of how to better utilize the technology. This awareness aids HVD implementations where desktop engineers and data center administrators work together.

Early adoption of this technology has been hindered by confusion around licensing, including compliance issues for the Windows Client OS. This has since been resolved through Microsoft Windows Virtual Desktop Access (VDA) licensing offerings; however, the cost still inhibits adoption for many customers. Licensing costs are only one aspect of the higher costs associated with implementing HVD on a broad scale; sizeable costs exist for necessary infrastructure build-outs. While many IT organizations made significant progress in virtualizing their data center server infrastructures, HVD implementations required additional virtual capacity for server and storage (above and beyond what was in place for physical to virtual migrations). Even with Microsoft's reduced license costs for the Windows OS, which enables an HVD image to be accessed from a primary and secondary device with one license, there are still other technical issues that hinder mainstream adoption.

Since late 2007, HVD deployments have grown steadily, reaching 25 million to 30 million users by the end of 1Q14. The broad applicability of HVDs has been limited to specific scenarios, primarily structured-task workers in call centers and kiosks, trading floors, and secure remote access. We expect that by 2018, there will be 50 million devices used to access HVDs. Throughout the second half of 2014 and into 2015, we expect general deployments to continue. Inhibitors to general adoption involve the cost of the data center infrastructure required to host the desktop images (servers and storage in particular) and network constraints. Even with the increased adoption of virtual infrastructures, cost-justifying HVD implementations remains a challenge because of HVD and PC cost comparisons. Some advancements in management tools (for example, application virtualization and image layering) make HVD less cumbersome by introducing the ability to more easily deploy applications. This makes managing the image and maintaining the HVD easier. Availability of the skills necessary to manage virtual desktops remains a challenge, as is deploying HVDs to mobile/offline users, despite the promises of offline VMs and advanced synchronization technologies.

Support for graphics processing units (GPUs; introduced in 2012) will eventually allow a broader audience, but will not have much impact until the end of 2014 and into 2015. Likewise, advances in storage technologies (that is, VSANs and SSDs) will help improve performance at lower costs.

User Advice: Through 2014 and 2015, all organizations should carefully assess the user types for which this technology is best-suited. Clients that make strategic HVD investments will gradually build institutional knowledge. These investments will allow them to refine technical architecture and organizational processes, and to grow internal IT staff expertise before IT is expected to support the technology on a larger scale through 2017. Balance the benefits of centralized management with the additional overhead of infrastructure and resource costs. Customers should recognize that HVDs may resolve some management issues, but will not become panaceas for unmanaged desktops. In most cases, the promised total cost of ownership (TCO) reductions will not be significant, and will require initial capital expenditures to achieve. The best-case scenario for HVDs remains securing and centralizing data management and structured-task users.

Organizations must optimize desktop processes, IT staff responsibilities and best practices to fit HVDs, just as organizations did with traditional PCs. Leverage desktop management processes for the lessons learned. The range of users and applications that can be viably addressed through HVDs will grow steadily through 2014. Although the user population is narrow, it will eventually include mobile/offline users. Organizations that deploy HVDs should plan for growing viability across their user populations, but should be wary of rolling out deployments too quickly. Employ diligence in testing to ensure a good fit of HVD capabilities with management infrastructure and processes, and integration with newer management techniques (such as application virtualization and software streaming). Visibility into future product road maps from suppliers is essential.

Business Impact: HVDs provide mechanisms for centralizing a thick-client desktop PC without re-engineering each application for centralized execution. This appeals to enterprises on the basis of manageability and data security.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: Citrix; Dell; Desktone; Microsoft; Red Hat; Virtual Bridges; VMware

Virtual Environments/Virtual Worlds

Analysis By: Jan-Martin Lowendahl; Marti Harris

Definition: Virtual environments or virtual worlds are online platforms in which participants are immersed in a three-dimensional representation of a virtual space.

Position and Adoption Speed Justification: For many topics (such as chemistry, biology and astronomy), being able to teach in three dimensions has obvious pedagogical value. The mix of three dimensions and social interaction that Second Life provided sparked a hype in education that was greater than for most technologies in recent years because of its huge promise in online and hybrid education.

The hype around virtual worlds has diminished considerably in higher education circles because the general-purpose use of environments like Second Life has not developed quickly enough from a usability and a business model point of view. The latter in particular has created uncertainty among educators who are looking for other options to safeguard their considerable investments in time in Second Life. However, real pedagogical successes continue in virtual worlds — not for the purpose of making virtual re-creations of real environments, but rather for creating experiences that can take place only in virtual environments, because they would otherwise be, for example, too complex, costly or even dangerous to do in real life.

Second Life, although still used, has given way to other virtual platforms that have proved to be more functional for simulations and experimentation, and whose "business models" are a closer fit to higher education, or have proved to be more sustainable and involve less risk. For example, the

open-source projects, such as OpenSimulator (http://opensimulator.org), represent the continued interest in and development of virtual worlds that retain the important function of being able to federate virtual worlds. A partly different path is represented by institutions that commission educational games on commercial gaming platforms, or that even buy commercial gaming platforms to develop their own virtual worlds. This latter path appears to add the gamification element to virtual environments, which can be another pedagogical benefit. Altogether, this merits a move onto the Slope of Enlightenment as the higher education community slowly figures out how to leverage virtual worlds in education.

User Advice: Use the "try before buying" strategy when available, experimenting with proven virtual environment platforms where other institutions have had a measure of success. Organizations such as the New Media Consortium (www.nmc.org) provide real application developments and uses. Expect continued growth of educational gaming and simulation. Encourage faculty and students to sample and explore. Expect simulation and gaming to find a place in the learning stack as subject-specific elements.

Business Impact: There will be effects on analysis, student performance, productivity and agility for knowledge transfer processes, teaching/learning and research support, decision support, training, R&D, intellectual capital management, and innovation.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Linden Lab; MindArk (Entropia Universe); Multiverse Software Foundation; Open Cobalt; OpenSimulator; SAIC

E-Textbook

Analysis By: Jan-Martin Lowendahl; Allen Weiner

Definition: E-textbooks are defined as content that is delivered electronically on user devices. Unlike traditional print materials, e-textbooks can be edited to include up-to-date information, be assembled or disassembled to rearrange the sequence or to include content from other sources, offer multimedia representation of information and instructional exercises, and allow users to insert personal notes or diagrams as study aids.

Position and Adoption Speed Justification: The momentum toward the adoption of e-textbooks comes from: (1) educators' views of digital content as a means of staying current in content areas and of keeping students engaged in learning activities; (2) an increasing number of relatively inexpensive, small form-factor devices (personally or institutionally owned) that are available for deployment in educational settings; (3) competition among traditional self-publishers; and (4) a new breed of rivals for anticipated e-textbook revenue.

State education agencies, such as those in California and Florida, have mandated or are considering requirements to replace print with digital content, and publishers are racing to get to market first.

The migration from print to digital content is viewed as a question of "when, not if," but not all education agencies are truly ready for the transition. The availability (or the will) of primary and secondary schools to provision or otherwise ensure access to user devices for all learners stands in the way. Several large universities are striking deals with publishers to bring down total cost and ensure availability of e-textbooks; in addition, a few institutions have gone 100% e-textbook. This merits a climb past the Trough of Disillusionment into the beginning of the Slope of Enlightenment. Still, publishers have not yet found or settled on the right business model, and the proliferation of general-purpose tablets and other mobile user devices needs to increase — at least in the K-12 space. Single-purpose devices that serve as content readers for digitized text were in the vanguard and are still being promoted, but e-textbooks on multipurpose devices (that is, with productivity and communication/collaboration tools) are more attractive options in the eyes of many education technology leaders.

User Advice: The business case for e-textbooks becomes stronger as the capital cost of user devices decreases, support and infrastructure resources are put in place, and current content providers either offer economic licensing agreements or get pushed aside by content providers willing to do so. Primary and secondary technology leaders should partner with curriculum planners to develop a business case that includes replacing print with e-content deployed to personally owned or assigned student devices. Institutions of higher education are likely to see wider adoption first in the use of e-textbooks that are electronic forms of print versions because of the wider availability of applications for user devices and because the content selection process will not require change.

Business Impact: E-textbooks will become the preferred content delivery mechanism throughout public and private education agencies and institutions. School organizations that provide digital content resources to students will be relieved of the liabilities of physical inventory, storage, distribution, repair (rebinding) and replacement because of loss. The confluence of decreases in device cost, the availability of multiple device form factors that can put e-textbooks in the hands of users, and consumer adoption of similar technologies are driving adoption.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Amazon; Apple; Houghton Mifflin Harcourt; McGraw-Hill; Pearson (LearningStudio)

Mobile-Learning Low-Range/Midrange Handsets

Analysis By: Nick Jones; Jan-Martin Lowendahl

Definition: Mobile-learning (m-learning) or learning administration applications use basic and enhanced phones. Such handsets range from ultra-low-cost devices capable of only voice and SMS and selling for less than $20, to more-capable handsets that support Web browsing and Java Platform, Micro Edition (Java ME). We separate m-learning on basic and enhanced handsets from m-learning on high-end smartphones, such as iPhones, because these will tend to be used in different ways, by different students and in different markets.

Position and Adoption Speed Justification: M-learning encompasses a broad range of applications including, but not limited to, media delivery (for example, audio and video), exploratory learning using augmented reality, educational games, collaboration and project work, e-books, surveys, tests, data gathering, real-time feedback, and simulations.

Technologically, low-end handsets can deliver m-learning in several ways. For example, this could be by using: (1) simple technologies, such as SMS — for example, for health education; (2) server-side technologies — for example, the mobile Web or, in some cases, using the handset just as a voice channel to listen to lessons broadcast from a server; (3) more-capable handsets that support stored media, such as podcasts or video; (4) native m-learning applications specially developed for low-end handsets and preloaded by the manufacturer; and (5) simple applications developed using widely available tools, such as Java ME. One of the challenges that determines m-learning application architecture in emerging markets is that data communications to a handset are often weak (for example, general packet radio service [GPRS] or SMS) and sometimes unavailable.

Examples of low-end m-learning deployments include simple tests and exams (for example, vocabulary tests for students learning a new language) and health education. Some low-end m-learning is delivered as a service predominantly for markets in developing countries — for example, Urban Planet Mobile's English language education. There is an increasing number of examples of services for more mature markets, such as the U.S., where more-innovative companies have developed an SMS-based SAT-prep-as-a-subscription service by exploiting the ubiquity of SMS functionality. Vendors such as Urban Planet keep adding markets, especially in developing countries. For example, together with 32 other companies, Urban Planet won a U.S. Agency for International Development (USAID) grant to deliver literacy education to Uganda in Rutooro (a local language).

However, price-sensitive emerging market subscribers are starting to adopt smartphones with retail prices for entry-level Android devices well under $50 in some markets in 2014; prices will fall to below $30 by 2016, driving a smartphone explosion in emerging markets. Although the specification of these ultra-low-cost smartphones will be weak, they will still be superior to feature phones for m-learning purposes. Therefore, we expect m-learning on midrange and low-end devices to wither before achieving the Plateau of Productivity.

User Advice: A real change to a curriculum must be based on a near 100% availability of a tool for the students. Educational organizations in which students own primarily low-end and midrange handsets should experiment with m-learning technologies and systems that match these devices. M-learning on low-cost devices will remain important in emerging markets, but organizations delivering content to handsets should plan for a migration to low-cost smartphone platforms, primarily Android.

Business Impact: Organizations such as network operators and handset manufacturers in emerging markets, where relatively few devices are smartphones, should explore the potential of educational services and applications delivered on low-range to midrange handsets. Organizations such as agricultural cooperatives that need to distribute information to large numbers of individuals owning low-end handsets should also explore m-learning techniques. Subscription m-learning services are a potentially interesting model for network operators and others in emerging markets because the low price points are outweighed by the potentially large number of learners.

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: Bharti Airtel; McGraw-Hill; Nokia; Urban Planet Mobile

Recommended Reading: "Cool Vendors in Education, 2011"

SaaS Administration Applications

Analysis By: Terri-Lynn B. Thayer

Definition: Software as a service (SaaS) for administration applications in education is software that is owned, delivered and managed remotely by one or more providers, based on a single set of common code and consumed in a one-to-many model by all contracted customers at any time, on a pay-for-use basis or as a subscription. (Student information system functionality is excluded from this technology profile.)

Position and Adoption Speed Justification: Educational administrative applications that may be delivered through SaaS include major business solutions, such as finance and HR software, and point solutions, such as those for employee recruitment, time and attendance, paycheck processing, and procurement. SaaS architectures are single-tenant, which support one customer per instance of the application, or multitenant, which accommodate multiple customers on a given instance of the application.

Over the past several years, the interest in SaaS has increased dramatically for education institutions. Typical attractions to the model are its economies of scale, speed of deployment, and opportunities to provide much needed innovation and agility. Adoption of these solutions has provided evidence for the growing recognition that the business requirements once thought unique to a particular organization can be met without a custom (or customized) solution. Many vendors now offering administrative solutions supporting higher education requirements do not offer a corresponding platform as a service (PaaS) to support customization. However, it may be possible to utilize other available PaaSs to supplement provided functionality.

Interest in broader SaaS offerings is rapidly increasing across the entire spectrum of higher education institutions, from community colleges to major research universities, which have demonstrated considerable interest in SaaS solutions for HR, payroll, finance and CRM. Workday's

SaaS multitenant higher education offerings are gaining ground — especially among institutions interested in reducing the intense IT focus required to support on-premises administrative technologies. Higher education institutions are driven to consider SaaS for a variety of reasons, including avoidance of high capital costs and disruption related to major upgrades, staff relief from maintaining a growing portfolio of customizations, and a desire for the consequent standardization of business processes inherent in adopting a SaaS solution. Multitenant solutions are by design often free of customization, and the institution benefits from frequent introduction of new functionality. However, the institution typically has limited control over the schedule of these upgrades.

Barriers to adoption include cultural proclivities and legal and security concerns. The culture of education shows a demonstrated preference for customized and/or self-built solutions. Legally, state, local and federal requirements for locating stored data or for the public disclosure of business practices that SaaS providers consider a competitive advantage can delay, if not stop, the implementation of a SaaS solution. However, adoption is expected to continue to accelerate as common business requirements will be driven by accountability mandates from the government.

User Advice: Best practices for considering administrative application requirements are re-examining needs and considering process and technology changes to meet business requirements. Build business cases to satisfy these business requirements that comprise the ongoing total cost of ownership for the range of solution models, including SaaS.

Assess institutional readiness to move from a capital-expenditure-heavy on-premises upgrade environment to a more predictable operating expenditure model in the cloud. Key elements of technical readiness should also be assessed, including network capacity and reliability, as well as strong integration tools, skills and architecture.

The key decision will often be reduced to balancing calls for customized, highly enterprise-specific requirements — and the costs that accompany them — versus the opportunities that may be offered through SaaS or other shared deployment models. Keep in mind that SaaS applications are a form of cloud computing and that the true test of deploying SaaS is the capacity to deliver your established performance indicators. Flexibility, control, customizability and scalability should all be carefully considered when adopting a SaaS solution.

Business Impact: SaaS offers academic institutions the opportunity to identify and concentrate on analyzing and using essential data without saddling them with the hardware, software and staffing requirements that accompany enterprise-hosted solutions. Education agencies and institutions that don't view their data requirements as unique will adopt SaaS. Those that do not see a common solution — and are willing to pay for the perceived critical differences between themselves and similar organizations — will not adopt SaaS.

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: Kronos; Oracle; SAP; Ultimate Software; UNIT4; Workday

Recommended Reading: "CIOs Should Clarify Roles and Responsibilities of IT for Cloud Applications in Higher Education"

"Best Practices for Supporting ERP/Business Applications in the Cloud"

"Manage and Optimize the Lifetime TCO for ERP"

Enterprise Architecture

Analysis By: Brian Burke; Philip Allega

Definition: Enterprise architecture (EA) is a discipline for proactively and holistically leading enterprise responses to disruptive forces by identifying and analyzing the execution of change toward desired business vision and outcomes. EA delivers value by presenting business and IT leaders with signature-ready recommendations for adjusting policies and projects to achieve target business outcomes that capitalize on relevant business disruptions. EA is used to steer decision making toward the evolution of the future-state architecture.

Position and Adoption Speed Justification: Leading EA programs continue to push the overall EA discipline further toward the Plateau of Productivity in the next two to five years. The overall maturity of EA by practitioners is improving, continuing to progress on the Slope of Enlightenment through 2014. Leading EA teams balance focus on transformational change while maintaining existing services.

Leading EA practitioners are business-outcome-driven, and evolve their EA programs with a focus on EA value realization rather than on the creation of artifacts for their own sake. EA programs have clearly shifted their positioning away from an inward view of IT systems alone to a broader vision of EA that guides their organizations and beyond to realizing their enterprise strategies and goals.

Continued movement up the Slope of Enlightenment in 2014 is driven by EA practitioners who are leading the evolution of EA in five key ways:

1. Focusing on business transformation
2. Integrating EA with business
3. Defining business outcome performance metrics
4. Working closely with business executives
5. Investing in EA (95% of leading programs invest 10% or more of their IT budgets on EA)

While EA is an established discipline in the majority of organizations, there continues to be large numbers of organizations that are either starting or restarting EA programs. Overall, EA maturity on Gartner's ITScore is 2.55 out of 5.00, leaving significant room for improvement. We believe a large number of EA practitioners are shifting focus to a more pragmatic business-outcome-driven EA approach, but, as a general practice, EA remains on the Slope of Enlightenment. As a larger number of EA practitioners become focused on delivering business outcomes, the EA practice will evolve to reach the Plateau of Productivity within the next two to five years. While it may seem to be a long

transition period, change comes slowly to the practice of EA, demonstrated by the fact that it has taken more than 25 years for EA programs to progress to the level of impact we are seeing today.

User Advice: Enterprise architects are making the switch from process-driven EA approaches to a business-outcome-driven EA. As noted in "Stage Planning a Business Outcome-Driven Enterprise Architecture," EA is a journey, not a destination. Each stage of the journey must be planned pragmatically, and be focused on a limited set of target business outcomes. Each iteration must deliver a highly valuable set of recommendations for business managers to execute.

Thinking in terms of stage planning guides, EA practitioners must think strategically to:

- Align EA to the highest-priority business outcomes.
- Streamline EA development to only create the deliverables that directly address the highest-priority business outcomes.
- Define a process to create those deliverables in a resource-efficient way.

Going forward, enterprise architects will be challenged to address an assortment of disruptive technologies that are emerging today such as smart machines, the Internet of Things (IoT), 3D printing, big data and gamification (see "Digital Business: 10 Ways Technology Will Disrupt Existing Business Practices"). Enterprise architects will need a renewed focus on disruptive technologies, and leaders will develop the role of vanguard EA (see "Predicts 2014: Enterprise Architect Role Headed for Dramatic Change").

Business Impact: Enterprise architects who 1) focus on the most significant business disruptions and outcomes that the organization faces, and 2) focus on the deliverables that will guide the organization through the required change are able to demonstrate the highest business impact and value.

High-value EA organizations' scope of EA change includes business, information, solutions and technology, and:

- Addresses opportunities for strategic and tactical change to enable the competitive positioning of the business in the future state.
- Identifies deficiencies in the current-state portfolio that must be resolved.
- Provides a set of constraints on projects to minimize complexity.

To support these activities and to address stakeholder issues, leading enterprise architects:

- Engage senior business and IT leadership to understand the goals of the organization.
- Clearly communicate business strategies, and articulate dependencies and requirements, to business leaders.
- Measure and deliver the value of EA, based on enabling business outcomes rather than on the internal tasks of developing EA artifacts.

Benefit Rating: High

Market Penetration: More than 50% of target audience

Maturity: Early mainstream

Recommended Reading: "Stage Planning a Business Outcome-Driven Enterprise Architecture"

"Define the Business Outcome Statement to Guide Enterprise Architecture Efforts"

"Predicts 2014: Enterprise Architect Role Headed for Dramatic Change"

IT Infrastructure Utility

Analysis By: Gianluca Tramacere; Philip Dawson; Claudio Da Rold

Definition: Infrastructure utility services (IUS) are the provision of outsourced, industrialized, asset-based IT infrastructure managed services below the business application functional layer. IUS are defined by service outcomes, technical options and interfaces, and are paid for based on resource usage, allocation or number of users served.

Position and Adoption Speed Justification: IUS represent the industrialized version of data center managed services and are integral to the evolution of that market. This market is significant and encompasses several delivery models. All types of providers in this space are increasingly addressing offerings branded as cloud, private cloud, hybrid cloud, utility or industrialized service solutions.

The most basic IUS style is utility hosting, which has evolved from traditional dedicated hosting via virtualization and is moving toward cloud IaaS. The most developed infrastructure utility (IU) offerings are currently built on standard infrastructure blocks, to which platform elements designed to support a specific application landscape are added. By using IUS, the client is still in full control of the customized applications, while the service provider develops and manages the operating platform up to a level below the logic of the application. The provider tailors the architecture/performance and price of the service to the application requirements — for example, billing per server, per gigabyte or based on the SAP Application Performance Standard.

Leading outsourcers are industrializing their delivery models, and virtual data center hosting companies are delivering IUS that increasingly leverage a cloud computing infrastructure that provides the basis of virtualization and low-level automation. Specialized companies, such as ThinkGrid, are also introducing virtualized desktop utility services into their service stack. A new set of utility services will be driven by the Nexus of Forces and the requirement to quickly enable consumers to use applications and services. Finally, public cloud compliance issues for regulated industries (such as banking, insurance, pharmaceutical and the public sector) make IUS an attractive model to provide shared and compliant services.

The impact of the evolution clearly affects the market, as IUS reduce the traditional data center outsourcing installed base. As cloud technology becomes more pervasive, more vendors are offering infrastructure utilities (such as Accenture, CSC and IBM private cloud for SAP). Increasing levels of adoption and competition have advanced the maturity of IU further, and software tool

providers and cloud specialists are raising the amount of the managed service work that can be automated to make the service more resilient and less expensive.

From 2009 through 2014, intense competition between competing infrastructure utility for SAP (IU4SAP) solutions brought down the price of this industrialized service significantly, showing that in many cases, the industrialization's next step will be low-cost services. Examples of current industrialized, one-to-many, low-cost IT services include virtualized servers available for $150 or less per server per month and IU4SAP, with typical values between $0.12 and $4 per managed SAPs per month compared with traditional client costs, which were much higher (see "Estimated Price Points for Industrialized Low-Cost IT Services"). Based on conversations with clients, we nevertheless acknowledge that the price does not necessarily go down elastically based on real-world usage, and it is more subject to managed changes over the life of the service relationship.

The move by large IU providers into offering public cloud services, the ongoing price war of cloud services by major providers and the announcement that Microsoft will deliver platform as a service (PaaS) and IaaS within Azure while matching Amazon prices further increase the potential for ongoing lowering of costs due to higher volume and full automation leverage.

In conclusion, the ongoing discussion about cloud delivery models ranging from private to hybrid to public, and the mix of hype, fear, uncertainty and doubt associated with cloud computing fuel interest in IUS, which are perceived as more secure and reliable than public cloud and are often marketed as "virtual private cloud."

User Advice: Organizations delivering their IT infrastructure services in-house should regularly monitor IUS offerings in the market. Increasingly, these offerings will become the external benchmarks for price, efficiency and flexibility. Some offerings will take the form of industrialized low-cost services.

Organizations considering outsourcing deals, utility or cloud IaaS offerings should:

- Concentrate on pricing units and pricing schema to understand the maturity of offerings. The degree of flexibility must align with client requirements and the offerings' maturity.
- Request references from other clients, and exercise due diligence in actively checking those references. Discuss transition issues as a key area of concern.
- Ask the provider to carefully describe the processes, automation tools and SLAs underpinning service delivery quality, reliability, compliance and efficiency. Focus on unit definition and pricing alone is insufficient to achieve the best value for the money.
- Request that providers communicate their service/architecture road maps to gain an understanding of how their offerings evolve over time and to judge the potential for lock-in into their specific architecture. Ask providers how they are moving from traditional to cloud-based IUS in the next few years.
- Start piloting or using IUS as part of their IT value chain and evaluate hidden costs, total cost of ownership (TCO) and transition cost during the pilot phases.

- Verify the impact of software licensing models when moving from dedicated to shared IU-based hosting solutions.

Business Impact: IT IUS can:

- Optimize the cost-efficiency and service effectiveness of IT infrastructure around virtualization.
- Increase flexibility in response to business requirements.
- Deliver an open, predefined and automated platform for innovation.

Clients must overcome significant cultural, financial and technical issues. Continuing economic uncertainty and the rise of cloud-enabled services solutions will accelerate the evolution toward industrialized and low-cost IT services.

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: Accenture; Atos; AT&T; BT Global Services; Capgemini; CenturyLink Technology Solutions; CGI; CSC; Dell; Fujitsu; HCL Technologies; HP; IBM; Rackspace; T-Systems; Telstra; Unisys; Verizon Enterprise Solutions

Recommended Reading: "IU4SAP Offerings: Accenture's Private Cloud Solution for SAP"

"Infrastructure Utility for SAP Applications: T-Systems' Dynamic Services for SAP Solutions"

"Infrastructure Utility for SAP Applications: HP ECS-Utility for SAP Offering"

"Infrastructure Utility for SAP: An Analysis of HCL Technologies' Offerings"

"Infrastructure Utility for SAP Applications: CSC CloudIU for SAP"

"Industrialized Low-Cost IT Services Drive Value, by Definition"

"Estimated Price Points for Industrialized Low-Cost IT Services"

"How Key Trends in the Data Center Infrastructure Outsourcing Market Will Affect Your Business"

"Riding the Wave of Industrialized Low-Cost IT Services"

"Data Center Services: Regional Differences in the Move Toward the Cloud, 2012"

Intellectual Property Rights and Royalties Management Software

Analysis By: Mike McGuire

Definition: Intellectual property rights and royalties (IPRR) systems — a class that includes intellectual property rights management (IPRM) — enable rights holders to index and associate specific business rules (including distribution rights information) with each piece of content under their control.

Position and Adoption Speed Justification: This profile of IPRR management software focuses on the media and content industries. Note that IPRR as a class includes patents, as well as applications, in the pharmaceutical, IT and education sectors. Some vendors mentioned herein are expanding into some of these other areas, but their primary focus is on media and entertainment opportunities.

Recent discussions with vendors and executives from content industries indicate a significant uptick in the demand for updating and automating IPRR processes. Much of the renewed interest is being driven by perceived efficiencies rights holders could see by moving some, not all, of their IPRR systems to cloud architectures. That interest, we believe, drove some interesting acquisitions in the second half of 2013 and the middle of 2014. First, Vistex, a global company delivering contract management solutions, acquired Counterpoint Systems. Second, FilmTrack acquired Jaguar Consulting, a longtime IPRR company.

Intellectual property (IP) that used to consist of a single episode, say, for a TV series, can be treated as literally hundreds of digital assets. Systems and processes used to track those assets have taken some time to catch up with the reality of online distribution and its effects on consumer consumption patterns. Adoption by rights holders of these systems is increasing because digital and mobile channels are starting to deliver meaningful revenue.

Content licensing, image licensing and music licensing agreements cover an already complex set of interlocking contractual arrangements that go into the development and distribution of copyrighted material. IPRR/IPRM platforms often include, run parallel to or tie into royalty tracking and settlement systems, given that each commercial transaction for copyrighted content typically requires a royalty payment. Typically, the software is a component in a digital distribution value chain at a content company, and it is used in conjunction with digital asset management solutions. The IPRR/IPRM systems provide the content company with a way to track the authorization or "clearance" of the rights-in/rights-out of a given work.

At the core, the IPRR/IPRM market is about providing content companies with the tools needed to know their inventory — what they have a right to sell and where and when — and to track and monetize it. With the explosion of the online distribution market — from video on demand and over-the-top video to online distribution via online stores — demand for robust IPRR/IPRM solutions will only increase as content companies scramble to find the tools required to legally and profitably meet this new demand.

User Advice: Media companies must keenly focus on their plans to automate these processes. The growth in online distribution, driven by the huge interest that consumers are showing in devices such as tablets, smartphones and other connected devices, mandates media companies invest in IPRR/IPRM platforms. Pay particular attention to the integration level offered for core business applications and the potential for growth.

Media companies must drive for standardization of lower-level issues such as definitions and metadata requirements for tagging content — knowing that a single piece of content can now be distributed or exploited in multiple ways — which are important requirements to fully leveraging these IPRR/IPRM platforms. Active participation is critical at the appropriate levels in industry efforts to develop high-level common-content IDs and the development of registries.

Business Impact: By enabling media companies to adapt to the new realities of online distribution and changing consumer interests, IPRR/IPRM affects IP management, sales, contract management and CRM. In contrast to businesses that are trying to protect their IP, media companies are trying to protect their assets while exploiting them across multiple distribution channels, which requires them to track content usage, enforce distribution contracts and calculate royalty payments to myriad stakeholders involved in the creation and distribution of the assets.

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Adolescent

Sample Vendors: FilmTrack; Mediamorph; Prodagio Software; SAP; Vistex (Counterpoint Systems)

Recommended Reading: "Amazon, Apple, Facebook, Google, Microsoft and Sony Lead the Fight for Media Supremacy in the Clouds"

Cloud Email for Staff and Faculty

Analysis By: Matthew W. Cain

Definition: Many institutions use no-fee cloud email services (which now include multiple collaboration services) for students, and more schools are beginning to use the same services for staff and faculty.

Position and Adoption Speed Justification: As more institutions have good experiences with cloud email services for students, they are increasingly considering the same service for staff and faculty. If we were simply considering cloud email for students, we could conclude that it has passed through the Hype Cycle and is fully mature. But when we consider cloud email for staff and faculty *only*, we place it just after the Trough of Disillusionment because adoption lags for nonstudents — mainly due to privacy and security concerns. Vendors are getting better at addressing control, security and legal concerns by, for example, making archive and discovery services available and offering support and management services. As a result of these investments, and a growing comfort with the cloud email model, we believe that the time to the Plateau of Productivity for all academic constituencies will be within two to five years.

User Advice: Institutions contemplating no-fee cloud email services for staff and faculty should evaluate the services using six core criteria:

- Economics

- Infrastructure alignment
- Features
- Migration effort
- Support/SLAs
- Security/privacy

Regarding the last point, institutions (working with internal security personnel) should assemble a checklist of the most critical security concerns to review with the vendors. The ability to access logs and mailboxes in case of an emergency should be understood. Support for Statement for Auditing Standards No. 70 (SAS 70) Type II and other certification should be compared. Privacy statements should be scrutinized side by side and passed by legal personnel for added input. Legal review should scrutinize accommodations for local regulations, such as the Family Educational Rights and Privacy Act (FERPA) in the U.S., and support for U.S.-EU Safe Harbor for non-U.S. institutions; support for e-discovery and hold requests should be part of the comparison. Legal personnel should also decide if scrutiny of data location and domestic hosting provisions are important. Organizations should also consider the added complexity of running different email systems for students and faculty/staff.

Business Impact:

- The cost of internally run email can be anywhere from $1 to $10 per user per month, so there can be significant savings for an institution moving to a no-fee cloud email service.
- Other advantages of cloud email deployments include vendor-supplied upgrades, redeployment of IT staff, very large mailboxes and built-in disaster recovery services.

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: Google; Microsoft

Recommended Reading: "Cloud E-Mail Decision-Making Criteria for Educational Organizations"

Open-Source Learning Repositories

Analysis By: Jan-Martin Lowendahl; Marti Harris

Definition: Open-source repositories are digital repositories, built on open-source software, for sharing digital media and content. They include multiple formats of digital types and are available by institutional ownership, subscription or institutional membership in a consortium. Faculty and students can use the repositories for peer review of content and to submit content for consideration.

Position and Adoption Speed Justification: A number of open-source repositories connect to the most prevalent learning platforms and can be referenced by users when building course content or learning/studying materials. Open-source repositories can allow for the exchange of content and experiences in the larger education community. Progress on standards will cause the pace of adoption to pick up, but faculty culture is still not attuned to reusable, object-level content. Even sharing traditional course content within a department is not as prevalent as it could be. Perhaps the competitiveness of the tenure process leads to, in effect, the copyrighting of the learning content within an institution. In institutions, learning repositories will give way to digital content repositories that are not for the sole purpose of holding learning content as more and various types of content will be incorporated into learning. However, open-access repositories allow for the acceptable use of shared digital content between members of academic communities globally who are not directly competing against each other. Both intellectual property and identity management are still important issues, but the simple solution of Creative Commons licensing is now spreading rapidly. In the global context, the Open Educational Resources movement is picking up speed in conjunction with the e-textbook trend, and we are almost seeing a second peak of hype. Altogether, this merits a successful climb of the Slope of Enlightenment and a quick ride to the plateau as more teachers warm up to the idea of open content supported by social-software-enabled global communities of educators.

User Advice: Consider open-source repositories to increase the performance of content access within a learning platform. Look for repositories with a track record of higher education integration with learning platforms. An open-source e-learning solution interfaced with a consortium-driven e-learning repository would be a powerful and economical solution for higher education institutions. Invest in some education regarding the Creative Commons licensing model.

Assess the willingness of faculty members and researchers to participate in open-source repositories, and identify barriers that may be removed early in these types of projects.

Business Impact: Affected areas include instruction, learning space, research and library management. With the continued rising cost of higher education, shared resources that are available through open-source repositories may provide improved ROI by making content and collaboration more accessible.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: Alfresco; DSpace; EPrints; Fedora; MERLOT

Unified Communications and Collaboration

Analysis By: Adam Preset

Definition: Unified communications and collaboration (UCC) describes a combination of communications and collaboration technologies. Network and telephony vendors provide

messaging, voice and video services across devices and computers. Collaboration includes personal productivity, enterprise groupware and social business applications. Distinctions blur as vendors such as Cisco, Avaya and Unify endeavor to penetrate collaboration markets, and others such as Microsoft, Google and IBM offer real-time communications services embedded in their platforms.

Position and Adoption Speed Justification: Because UCC represents the merging of former, distinct marketplaces, there are significant hurdles to overcome when considering it for enterprise use. Typically, portfolios of products from two or more vendors are blended to provide the UCC experience. The integrity of these integrations requires that IT deploy software releases from both the vendors that are in lockstep with each other as well as qualified personnel who can maintain the needed systems in parallel. The goal for end users is to shift up and down the available media as seamlessly as possible: If they start in IM, they want to be able to escalate to a voice call or a videoconference, drawing in the right participants, and move the collaboration activity among handsets, mobile devices, computers and video systems.

Vendors have added functionality to their product suites that overlap or compete directly with other products that are brought in-house for completely different reasons. It is common to find real-time collaboration tools that include IM, voice, desktop sharing and Web conferencing. In some cases, peer-to-peer voice functionality is good enough that it can displace some of the audio usage in enterprise telephony and conferencing services. This can be empowering and convenient for end users, but the overlap can be confusing to rationalize and explain. Collaboration vendors may not have high-quality communications. Communications vendors may not offer a quality user experience. Seamless UCC remains an aspiration for most suppliers. Subsequently, the promise of UCC has not yet been realized for many enterprises.

Because UCC workloads take advantage of IP networks, organizations are — sometimes slowly — converging on staffing models in which IT departments that are responsible for collaboration and productivity work closely with or have the same reporting line as networking, telephony and infrastructure groups.

End users have a varied and complicated set of tools that they can use for working together, and they require consistent interfaces that are self-explanatory. Software clients and mobile apps are the unifying interfaces that hide some of the back-end complexity. Social technology is the next potential area of unification as activity streams and enterprise social network functionality overlaps with or incorporates IM and other communications capabilities. Increasingly, UCC solutions are being called upon as infrastructure to support communication between internal and external audiences.

Consumerization is also driving user expectations in this area. If Facebook, Google and Apple can mix communications and collaboration, then why can't enterprise vendors? Experiences with Google Hangouts as a consumer can influence acceptance of its capabilities for business use, especially when combined with collaboration tools that allow real-time creation and consumption of enterprise content. Straddling the consumer space with Skype and the enterprise space with Lync, Microsoft is being called upon to blend and integrate communication between those platforms.

User Advice: Create a joint task force to develop a UCC strategy that is made up of communications, network and collaboration specialists, as well as representatives from management and lines of business, to reduce interdepartmental friction. That group should investigate cloud options as seriously as on-premises solutions.

Separate the organizational and budget politics from an evaluation of the benefits of enhancing users' communication and collaboration capabilities. Users need some of both. For many users, it may generally be better if they are more integrated (unified) than not. A UCC project can produce both benefits and unintended drawbacks. In some cases, it could needlessly disrupt current and effective work practices, add complexity, and potentially be seen as unnecessary, costly and a waste of human and technical resources. In other cases, it can improve communications, augment work performance, increase effectiveness and help disparate virtual teams to excel. Some employees may do better with, and some do better without, UCC. Do not treat this as an all-or-nothing proposition for every user. Allow some degree of overlap and redundancy if it proves to be beneficial or is more convenient. If appropriate, provide guidance around use cases, but also express and act on a willingness to allow teams and individuals to self-organize and blend the collaboration tools that are provided to build their own workflow. Determine the right capabilities road map for various user segments, and work the organizational and budget politics into a separate, parallel path.

To become more familiar with the possibilities and prove the value of UCC, first look for groups of users that already understand the potential benefits and business cases that provide the clearest path to a measurable return. These test cases can help build the case for more widespread deployment.

Business Impact: Users expect to be able to employ an integrated set of collaboration tools, escalating to the highest value combination of interactive services — both inside and outside the firewall and including fixed, wireless and mobile networks — for the business task at hand. Presence services will be a vital unifying tool, enabling users to right-click on a name and invoke a variety of collaboration mechanisms. Shared team spaces will include presence and activity stream data and provide temporary and persistent repositories for interactions. These capabilities will be available as a complete stack from some vendors. Standards-driven integration will make even more combinations possible. Large enterprises will likely need a portfolio of solutions to cover "good enough for most" and "best of breed for a few."

The value to organizations will be realized in several ways. Unified systems and interfaces will simplify the user experience. Individuals and groups can accelerate the reaction to market events. Embedding contextual communication into applications will improve process disconnect and allow humans to intervene.

Identifying the potential value of UCC is easy, but what organizations will struggle with is quantifying the benefits and calculating ROI. Companies may need to eschew traditional ROI mechanisms and look for alternative, less quantifiable means to justify UCC investments, such as process cycle acceleration, faster problem remediation, increased information awareness, and the inclusion of more internal and external resources in planning processes.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: Avaya; Cisco; Google; Huawei Technologies; IBM (Lotus); Microsoft; Unify

Recommended Reading: "Unified Communications and Collaboration Key Initiative Overview"

"What You Need to Know to Succeed in the UCC Market"

"Single-Vendor or Multivendor UCC: Which Approach Is Best for You?"

Lecture Capture and Retrieval Tools

Analysis By: Jan-Martin Lowendahl

Definition: Lecture capture and retrieval tools are two sets of complementary tools that are often presented as a suite. Lecture capture tools perform live recordings, including voice and relevant visual material, in as complete a manner as possible. Lecture retrieval tools aid students in retrieving the whole lecture, or just the parts that are relevant to their learning needs.

Position and Adoption Speed Justification: Several proven solutions are on the market, and some institutions are beginning their second-generation RFP rounds as they seek to expand or update their lecture capture efforts. However, traditional lecture capture in particular still has only partial uptake at many institutions, mainly due to cost and perceived complexity, but also because of some educator push-back. This is why we're seeing an increase in personal and consumer solutions — such as regular digital video cameras or, for example, the combination of an iPad and Swivl — where low cost and personal control are main factors in these solutions' relative preference among educators. This focus on personal tools makes it even more important for institutions to implement good content management systems or software as a service (SaaS) that can handle storage, indexing and retrieval. We see lecture capture and retrieval as an institutional capability that is well into the Slope of Enlightenment, and that has a quick path to the plateau — even if the way to implement it has changed somewhat, given more consumer options.

User Advice: User acceptance is key to deployment in terms of functionality and instructors' acceptance of being recorded. Pilot implementations with thorough evaluation and stakeholder involvement are a must. Such evaluation must include: (1) ease of use and convenience; and (2) ease of deployment, as well as search/indexing and "playback" functionality for students. However, beware of the social and behavioral issues involved with these solutions. Initially, faculties are not accustomed to being recorded, or to the additional preparation time needed to teach with this tool. Faculty support must be addressed seriously. However, it can be expected that younger generations (faculty and students) will become increasingly accustomed to peer-created content, and they will realize that recorded lectures should not be compared with Hollywood production standards. Expectations will then focus on the learning qualities rather than the production qualities.

Consider statistical functions that help to monitor student usage — coupled with, for example, student success and student retention. Seek a solution that can be integrated with e-learning platforms. Consider SaaS solutions to minimize storage implications.

Business Impact: Lecture capture and retrieval tools have been shown to have some positive effect on student grades and retention, and they promise to be important pedagogical tools. The ability to index lectures and offer playback of selected passages has proved to be key to these positive results. However, they are just two of the many tools that are needed, and they can never replace good teaching. They can only extend its reach. Practical benefits include review, improved scores, improved retention, convenience, and a new option for students to make up for planned or unplanned absences.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Mature mainstream

Sample Vendors: Cisco; Echo360; Panopto; Sonic Foundry; Swivl; Tegrity; Winnov

Entering the Plateau

802.11n

Analysis By: Tim Zimmerman

Definition: The 802.11n standard is a wireless LAN (WLAN) standard ratified by the IEEE that improves the throughput of devices and access points at 2.4GHz or 5GHz. A single spatial stream operating within a 20MHz channel width can achieve 75 Mbps throughput for either 2.4GHz or 5GHz implementations. However, most vendors offer two or three stream radios that are capable of a throughput of up to 450 Mbps for 5GHz. Like previous 802.11 standards, 802.11n provides backward-compatibility with 802.11a, 802.11b and 802.11g standards.

Position and Adoption Speed Justification: The market movement to 802.11n has been steady. The 802.11n standard is subject to the same considerations as other access points — autonomous versus coordinated, controller based versus controllerless versus in the cloud, or with one, two or three integrated radios within the access point.

User Advice: IT leaders should consider dual-radio (2.4GHz and 5GHz) 802.11n for all their WLAN requirements, even when looking at 802.11ac Wave 1. Any usage scenario for 2.4GHz will require 802.11n, while enterprises will have the option of using 802.11n or 802.11ac for 5GHz bandwidth requirements that are less than 450 Mbps and 802.11ac for all others that require higher performance. Most enterprises do not need the higher throughput of 802.11ac for any current or future usage scenarios and therefore should not pay a premium for unneeded bandwidth.

Business Impact: Consider 802.11n for all WLAN scenarios within the enterprise, including small branch, remote office or large enterprise solutions. We believe that 802.11n will enable sufficient

bandwidth and support of required capabilities (such as quality of service) for many enterprises to consider for moving their data, voice and video applications to the WLAN.

Benefit Rating: Moderate

Market Penetration: More than 50% of target audience

Maturity: Mature mainstream

Sample Vendors: Aerohive Networks; Aruba Networks; Cisco; HP

Recommended Reading: "Magic Quadrant for the Wired and Wireless LAN Access Infrastructure"

"Use Best Practices to Implement a WLAN"

"Best Practices for WLAN Site Surveys That Save Money"

Game Consoles as Media Hubs

Analysis By: Mike McGuire

Definition: "Game consoles as media hubs" refers to the proprietary software applications that, along with broadband connectivity, enable game consoles to deliver broadband premium content services, including music, TV and movie offerings (such as those from Netflix and Hulu). Most content options are delivered on demand, but increasingly live TV programming is also available (although authentication is required).

Position and Adoption Speed Justification: Throughout 2012 and into 2014, game console vendors continued to refine and expand the positioning of their consoles as multimedia hubs for consumers. In particular, the sector's two major players, Sony and Microsoft, both released new versions of their flagship consoles. These updates have come at a tumultuous time in the console gaming world: Online and mobile games are increasingly popular and enable the (relatively) faster design, development and distribution of game titles. Microsoft (with its Xbox One) and Sony (with its PlayStation 4) have been integrating existing online video services, such as Netflix and Hulu (Sony's sister company, Sony Pictures, has the Crackle service). Both platforms offer a robust set of on-demand content, as well as supporting live streaming.

A key challenge for the vendors is convincing hard-core gamers — the consumers that put these consoles in a position to expand beyond gaming — that the new platforms are still powerful and engaging gaming devices. To some degree, these consoles compete with over the top (OTT) set-top box (STB) vendors, such as Roku, Boxee, Amazon Fire TV and Apple TV. However, the new consoles are relatively expensive — standard retail pricing is $499 for Xbox One and $399 for PlayStation — and they cost considerably more than what OTT STB manufacturers charge (typically $100 or less). (It should be noted that the Amazon Fire TV OTT STB has game-playing capabilities and its own controller.) Yet, by opening up their platforms for applications from content or service companies, console vendors have an expansion capability that OTT STB vendors might be hard-pressed to match.

Long-term strategic hedges by multichannel video programming distributors (MVPDs) are also in place as they extend their programming to these consoles, with perhaps the ultimate goal of creating virtual STB functionality to provide authentication and billing/provisioning capabilities normally handled by a proprietary STB.

A new class of enablers is likely to help extend the value of game consoles as media hubs by providing rapid application development and deployment for broadcasters, cable networks, sports leagues and even brands with extensive video/content assets. Companies such as 1 Mainstream and B2B service providers (such as Verizon Digital Media Services) give content providers a platform to deliver content/services to applications that run on game consoles, as well as on OTT STBs and other connected devices.

User Advice: Movie studios, cable networks, and others that develop and distribute original video content should continue to support distribution opportunities with the game console customer base. Content companies should take advantage of the unique opportunities to create new interactive features and audience engagement possibilities offered by sensor devices such as Xbox Kinect. Not all content will be appropriate for such treatment, but serial content that has an affinity with gaming genres is ideal.

Content companies already licensing content to console manufacturers through aggregators, such as Netflix or Hulu, should explore more aggressive experiments with release windows — for example, more premium rental windows. These one-time rentals usually involve a premium over and above a typical movie rental of titles that are either in the theatrical or initial broadcast (of a TV show) windows. Content owners should use escalating competition among aspiring connected-home hardware providers (Apple, Google and Amazon) and MVPDs to their advantage in negotiating content licenses.

Experienced interactive content application developers will be in demand by content companies and MVPDs looking to differentiate content offerings on the consoles.

Business Impact: The business impacts are mainly in incremental distribution market opportunities for media companies. Advertising opportunities — that is, beyond the in-stream advertisements that could come with the content a la Hulu — are uncertain, but Microsoft is still pursuing advertising on Xbox and in June 2012 announced the NUads format for the Xbox and Surface ecosystems. However, for pay content services, game consoles represent another (relatively) secure distribution point in the connected-device universe, with unique (at least in the near term) interactive capabilities.

Benefit Rating: Moderate

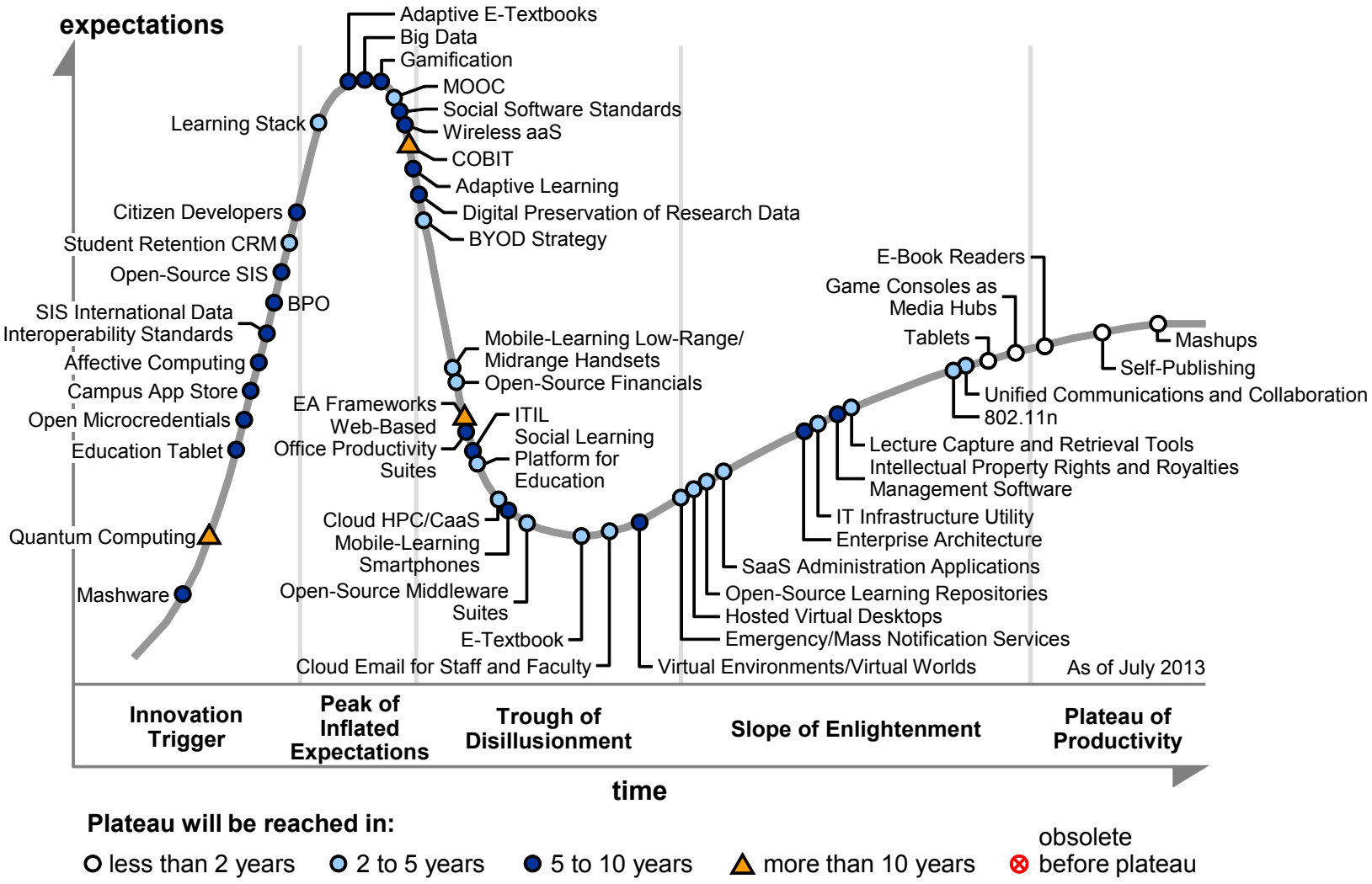
Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: Microsoft; Nintendo; Sony

Appendixes

Figure 3. Hype Cycle for Education, 2013



Source: Gartner (July 2013)

Hype Cycle Phases, Benefit Ratings and Maturity Levels

Table 1. Hype Cycle Phases

Phase	Definition
Innovation Trigger	A breakthrough, public demonstration, product launch or other event generates significant press and industry interest.
Peak of Inflated Expectations	During this phase of overenthusiasm and unrealistic projections, a flurry of well-publicized activity by technology leaders results in some successes, but more failures, as the technology is pushed to its limits. The only enterprises making money are conference organizers and magazine publishers.
Trough of Disillusionment	Because the technology does not live up to its overinflated expectations, it rapidly becomes unfashionable. Media interest wanes, except for a few cautionary tales.
Slope of Enlightenment	Focused experimentation and solid hard work by an increasingly diverse range of organizations lead to a true understanding of the technology's applicability, risks and benefits. Commercial off-the-shelf methodologies and tools ease the development process.
Plateau of Productivity	The real-world benefits of the technology are demonstrated and accepted. Tools and methodologies are increasingly stable as they enter their second and third generations. Growing numbers of organizations feel comfortable with the reduced level of risk; the rapid growth phase of adoption begins. Approximately 20% of the technology's target audience has adopted or is adopting the technology as it enters this phase.
Years to Mainstream Adoption	The time required for the technology to reach the Plateau of Productivity.

Source: Gartner (July 2014)

Table 2. Benefit Ratings

Benefit Rating	Definition
Transformational	Enables new ways of doing business across industries that will result in major shifts in industry dynamics
High	Enables new ways of performing horizontal or vertical processes that will result in significantly increased revenue or cost savings for an enterprise
Moderate	Provides incremental improvements to established processes that will result in increased revenue or cost savings for an enterprise
Low	Slightly improves processes (for example, improved user experience) that will be difficult to translate into increased revenue or cost savings

Source: Gartner (July 2014)

Table 3. Maturity Levels

Maturity Level	Status	Products/Vendors
Embryonic	▪ In labs	▪ None
Emerging	▪ Commercialization by vendors ▪ Pilots and deployments by industry leaders	▪ First generation ▪ High price ▪ Much customization
Adolescent	▪ Maturing technology capabilities and process understanding ▪ Uptake beyond early adopters	▪ Second generation ▪ Less customization
Early mainstream	▪ Proven technology ▪ Vendors, technology and adoption rapidly evolving	▪ Third generation ▪ More out of box ▪ Methodologies
Mature mainstream	▪ Robust technology ▪ Not much evolution in vendors or technology	▪ Several dominant vendors
Legacy	▪ Not appropriate for new developments ▪ Cost of migration constrains replacement	▪ Maintenance revenue focus
Obsolete	▪ Rarely used	▪ Used/resale market only

Source: Gartner (July 2014)

Gartner Recommended Reading

Some documents may not be available as part of your current Gartner subscription.

"Understanding Gartner's Hype Cycles"

"Predicts 2014: Technology Drives Education Toward Transformation"

"Cool Vendors in Education, 2014"

"2014 CIO Agenda: An Education Perspective"

"Agenda Overview for Higher Education, 2014"

"Agenda Overview for K-12 Education, 2014"

Evidence

Venture Capital Database

Note 1 Customizing the Hype Cycle

See the " My Hype Cycle" Toolkit, which is updated yearly (usually in October) after the publication of all Gartner's Hype Cycles (for example, see "Toolkit: My Hype Cycle, 2013").

More on This Topic

This is part of an in-depth collection of research. See the collection:

- Gartner's Hype Cycle Special Report for 2014

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