Trend #1: Preparing Future Technical Workforce
We are seeing an unprecedented rate of growth between postsecondary education and economic opportunity.

Trend #2: Emerging Technology
"Gartner's 2016 Hype Cycle reveals three distinct technology trends that profoundly create new experiences, with unrivaled intelligence, and offer platforms that propel organizations to connect with new business ecosystems in order to become competitive over the next five to 10 years."

Trend #3: Digitization of Education
The digitalization of education is gaining more mind share of academic and school leadership. However, the full advantage of digitalization requires a concerted change in people, process and technology, which makes IT a team sport. IT can no longer be expected to come up with the right solution in isolation.

Trend #4: The Programmable or "App" Economy
Digital business innovation creates disruptive effects that have a wide-ranging impact on people and technology. However, secondary ripple effects will often prove to be more disruptive than the original disruption. Digital strategists must actively identify secondary effects when planning change.

Trend #_1_	**Preparing Future Technical Workforce**: we are seeing an unprecedented rate of growth between postsecondary education and economic opportunity.
	What is driving this transformation? In a word: **technology**
	Technology – led by information technology – has been automating repetitive tasks and activities. As a result, more jobs are non-repetitive and require skills beyond high school. (p.16)
	"*The Future of Work: Thinking about the Future of Work to Make Better Decisions about Learning Today*" EDUCAUSE Review; May/June 2016 https://er.educause.edu/~/media/files/articles/2016/5/erm1631.pdf
Direction of Change for the next 3-5 years	• Since 1973, the share of jobs requiring at least some college education has increased from 28 percent to at least 60 percent. • By 2020, it is estimated that 65 percent of all jobs in the United States will require some form of postsecondary education or training. • The fastest growing sectors of the economy will be those that require post-secondary education.

Probability of change for the next 3-5 years	• The college will need to continue to establish intentional program goals in response to local, state, national and global trends. • Course titles and syllabi need to align with future workforce demands/skills. • The college will need to continue to expand the use of student pathways, CRM, and predictive analytics. • JCCC should examine what general education means in light of a future-based skill set. • JCCC needs to continue to collaborate with K-12 and employers to be a strategic partner in the technology-driven economy as employers are seeking a mix of the hands-on training and higher level thinking skills.
Opportunity or Threat	"Schools are gradually realizing that traditional, theory-focused computer science curriculum leaves gaps between what students are learning and what they need to do in the real world… We're far away from the point when university computer science courses can offer what they need for practical applications." *A coding camp specifically designed for college students*; University Business https://www.universitybusiness.com/news/coding-camp-specifically-designed-college-students **The number of women employed in technology positions is decreasing rather than increasing**. • The National Center for Women and Information Technology reported that in 2014, only 26 percent of professional computing jobs in the United States were held by women. • The percentage of women awarded computer science degrees has actually decreased, from 37 percent in 1985 to 18 percent in 2013. • Further, over 50 percent of women in technology positions leave their employers midcareer. • By 2024, 1.1 million computing-related job openings are expected. At the current rate, only 41% of these jobs could be filled by U.S. computing bachelor's degree recipients. (p. 1) "The Midwest, which produces 100,000 more graduates than the Northeast in any given year, will face an even steeper decline. The biggest producers of high schools graduates in the Midwest — Ohio, Michigan, and Illinois — will all experience historic downturns, with Michigan ending with 86,000 fewer graduates by 2028, **a nearly 30 percent drop from 2009**. (p.10)" https://chronicle-store.com/ProductDetails.aspx?ID=80579&WG=350
Support Rationale	A recent Mc-Kinsey & Company study claims that fewer than 5 percent of occupations can be entirely automated using current technology. However, about 60 percent of occupations could have 30 percent or more of their constituent activities automated.[7] In other words, automation is likely to change the vast majority of occupations—at least to some degree—which will necessitate significant job redefinition and a transformation of business processes. (Which will drive IT reinvention) "*The Future of Work: Thinking about the Future of Work to Make Better Decisions about Learning Today*"

	https://er.educause.edu/~/media/files/articles/2016/5/erm1631.pdf
Sources	*"Higher Education and Democratic Capitalism"* http://er.educause.edu/articles/2016/10/higher-education-and-democratic-capitalism *"The Future of Work: Thinking about the Future of Work to Make Better Decisions about Learning Today"* https://er.educause.edu/~/media/files/articles/2016/5/erm1631.pdf *"The Tech Talent Wars and #WomenInTech"* http://er.educause.edu/articles/2015/10/the-tech-talent-wars-and-womenintech *"Why Aren't More Girls Coding? The Answer Is a Bummer"* https://www.youtube.com/watch?v=DDNncQK89LM *"A Selection of Indicators from Education at a Glance 2016"* http://gpseducation.oecd.org/Home *"NCWIT's Women by the Numbers"* www.ncwit.org/bythenumbers

By the Numbers

Women and Information Technology

57 — Percent of professional occupations in the 2015 U.S. workforce held by women

25 — Percent of professional computing occupations in the 2015 U.S. workforce held by women

17 — Percent of Fortune 500 Chief Information Officer (CIO) positions held by women in 2015

1.1 million — Number of U.S. computing-related job openings expected by 2024

41 — Percent of these jobs that could be filled by U.S. computing bachelor's degree recipients by 2024

56 — Percent of Advanced Placement (AP) test-takers in 2015 who were female

47 — Percent of AP Calculus test-takers in 2015 who were female

22 — Percent of AP Computer Science test-takers in 2015 who were female

59 — Percent of 2015 Intel Science and Engineering Fair (ISEF) finalists in Biology categories who were female

25 — Percent of 2015 ISEF finalists in Mathematics who were female

23 — Percent of 2015 ISEF finalists in Computing categories who were female

57 — Percent of 2014 bachelor's degree recipients who were women

17 — Percent of 2014 Computer and Information Sciences bachelor's degree recipients who were women

15 — Percent of 2014 Computer Science bachelor's degree recipients at major research universities who were women

37 — Percent of 1985 Computer Science bachelor's degree recipients who were women

21 — Percent increase in the number of first-year undergraduate women interested in majoring in Computer Science between 2000 and 2015

25 — Percent of computing workforce who were women in 2015

3 — Percent of computing workforce who were African-American women in 2015

5 — Percent of computing workforce who were Asian women in 2015

1 — Percent of computing workforce who were Hispanic women in 2015

Trend #_2_	Emerging Technology – "Gartner's 2016 Hype Cycle reveals three distinct technology trends that profoundly create new experiences, with unrivaled intelligence, and offer platforms that propel organizations to connect with new business ecosystems in order to become competitive over the next five to 10 years." *Hype Cycle for Emerging Technologies, 2016*; Published: 19 July 2016
Direction of Change for the next 3-5 years	**1) Transparently immersive experiences** Technology has and will continue to become more human-centric to the point where it will introduce transparency between people, businesses and things. This relationship will become much more entwined as the evolution of technology becomes more adaptive, contextual and fluid within the workplace, at home, and interacting with businesses and other people. **2) Perceptual smart machine age** Smart machine technologies will be the most disruptive class of technologies over the next 10 years due to radical computational power, near-endless amounts of data, and unprecedented advances in deep neural networks that will enable organizations with smart machine technologies to harness data in order to adapt to new situations and solve problems that no one has never encountered previously. **3) Platform revolution** Emerging technologies are revolutionizing our concepts of how we define and use platforms. The shift from technical infrastructure to ecosystem-enabling platforms is laying the foundations for entirely new business models that are forming the bridge between humans and technology. Within these dynamic ecosystems, organizations must proactively understand and redefine their strategy to create platform-based business models, and to exploit internal and external algorithms in order to generate value.
Probability of change for the next 3-5 years	The consumer experience will change dramatically within the next 10 years. The college will need to integrate these technologies into the learning experience in order to stay relevant. • The consumer technology experience needs to be present in both the online and seat-time offerings; this will have implications for the budget and technology refresh cycle • The consumer technology training portfolio will experience dramatic change • Businesses will continue to seek an education partner to showcase and train on the use of these technologies in the workplace • Employees and students need to learn how to access and filter the immense quantity of information that is available to them.
Opportunity or Threat	This trend presents both an opportunity and a threat for the education industry as a whole with the consumer experience becoming more personalized through the use of badges and competency based education (CBE).

| Support Rationale | **1) Transparently immersive experiences**
Technology has and will continue to become more human-centric to the point where it will introduce transparency between people, businesses and things. This relationship will become much more entwined as the evolution of technology becomes more adaptive, contextual and fluid within the workplace, at home, and interacting with businesses and other people.

Critical technologies to be considered include 4D Printing, Brain-Computer Interface, Human Augmentation, Volumetric Displays, Affective Computing, Connected Home, Nanotube Electronics, Augmented Reality, Virtual Reality and Gesture Control Devices.

2) Perceptual smart machine age
Smart machine technologies will be the most disruptive class of technologies over the next 10 years due to radical computational power, near-endless amounts of data, and unprecedented advances in deep neural networks that will enable organizations with smart machine technologies to harness data in order to adapt to new situations and solve problems that no one has never encountered previously.

Enterprises that are seeking leverage in this theme should consider the following technologies: Smart Dust, Machine Learning, Virtual Personal Assistants, Cognitive Expert Advisors, Smart Data Discovery, Smart Workspace, Conversational User Interfaces, Smart Robots, Commercial UAVs (Drones), Autonomous Vehicles, Natural-Language Question Answering, Personal Analytics, Enterprise Taxonomy and Ontology Management, Data Broker PaaS (dbrPaaS), and Context Brokering.

3) Platform revolution
Emerging technologies are revolutionizing our concepts of how we define and use platforms. The shift from technical infrastructure to ecosystem-enabling platforms is laying the foundations for entirely new business models that are forming the bridge between humans and technology. Within these dynamic ecosystems, organizations must proactively understand and redefine their strategy to create platform-based business models, and to exploit internal and external algorithms in order to generate value.

Key platform-enabling technologies to track include Neuromorphic Hardware, Quantum Computing, Blockchain, IoT Platform, Software-Defined Security and Software-Defined Anything (SDx).

Hype Cycle for Emerging Technologies, 2016; Published: 19 July 2016

Higher Education Examples:
http://www.edtechmagazine.com/higher/article/2016/10/qa-indiana-virtual-reality-poised-bring-high-impact-experiences-classroom

http://www.edtechmagazine.com/higher/article/2016/10/campus-libraries-write-new-chapter |

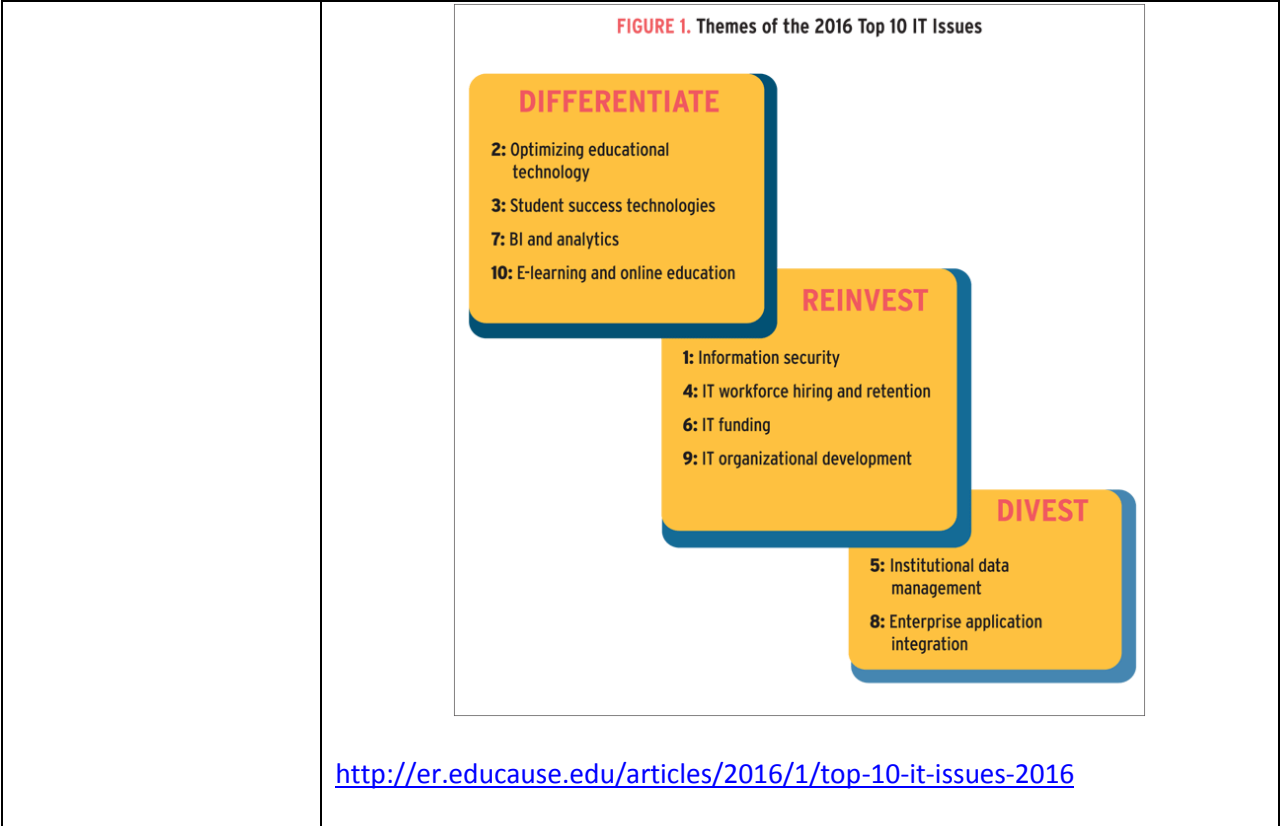| Sources	**Hype Cycle for Emerging Technologies, 2016**; Published: 19 July 2016

Here are links that demonstrate examples of "critical technologies" from the Hype Cycle:

http://www.edtechmagazine.com/higher/article/2016/10/qa-indiana-virtual-reality-poised-bring-high-impact-experiences-classroom

http://www.edtechmagazine.com/higher/article/2016/10/campus-libraries-write-new-chapter

Trend #_3_	**Digitization of Education** – the digitalization of education is gaining more mind share of academic and school leadership. However, the full advantage of digitalization requires a concerted change in people, process and technology, which makes IT a team sport. IT can no longer be expected to come up with the right solution in isolation. This requires tools for leadership collaboration and a common context to drive change. Each stakeholder needs to express expectations, needs and outcomes in a common language that helps the team identify and execute on the right solutions.
Direction of Change for the next 3-5 years	By 2020, at least 10% of higher education institutions will use smart machines to improve student success. By 2020, one-third of institutions will support university admission with a combination of point solutions, CRM and business process outsourcing (BPO), rather than the student information system (SIS). By 2020, at least 50% of K-12 organizations will be using some type of digital content management. By 2020, over 10% of higher education institutions will have eliminated the traditional "final exam" in science, technology, engineering and math (STEM), relying instead on integrated assessment in adaptive learning. By 2018, at least 30% of higher education institutions globally will have a learning analytics strategy to improve student outcomes "*Predicts 2016: Building the Foundation for the Digitalization of Education*" Gartner Published: 17 November 2015 ID: G00292703
Probability of change for the next 3-5 years	In 2016, higher education IT organizations are divesting themselves of technologies that can be sourced elsewhere and of practices that have become inefficient and are reinvesting to develop the necessary capabilities and resources to use information technology to achieve competitive institutional differentiation in student success, affordability, and teaching and research excellence.

FIGURE 1. Themes of the 2016 Top 10 IT Issues

DIFFERENTIATE
2: Optimizing educational technology
3: Student success technologies
7: BI and analytics
10: E-learning and online education

REINVEST
1: Information security
4: IT workforce hiring and retention
6: IT funding
9: IT organizational development

DIVEST
5: Institutional data management
8: Enterprise application integration

http://er.educause.edu/articles/2016/1/top-10-it-issues-2016

Opportunity or Threat	This trend is an opportunity for JCCC as functional area leadership has partnered with Information Services to bolster the strategy supporting many of these technologies, such as: Predictive Analytics, CRM, Listening and Sensing Technologies, and Collaboration Technology.
Support Rationale	Gartner's Top 10 Strategic Technologies Impacting Higher Education in 2016: Adaptive learning takes two major forms: (1) textbooks, where algorithms are packaged with content from a publisher for an end user; and (2) platforms, where end users add their own content to an adaptive learning environment. Predictive analytics involves extracting an analytical model from multiple sources of data to predict future behavior or outcomes. Customer relationship management (CRM) technologies are tools that track and manage relations with constituents, including prospective as well as enrolled students, parents, alumni, corporations, benefactors and other friends of the institution. Exostructure strategy means acquiring the critical capability of interoperability as a deliberate strategy to leverage the increasing numbers of partnerships, tools and services in the education ecosystem. Open microcredentials are ecosystems of open digital "signs," "certificates" 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). They are referred to as "micro" because the most often represent atomic levels of achievement rather than the multiyear endeavors represented by a diploma.

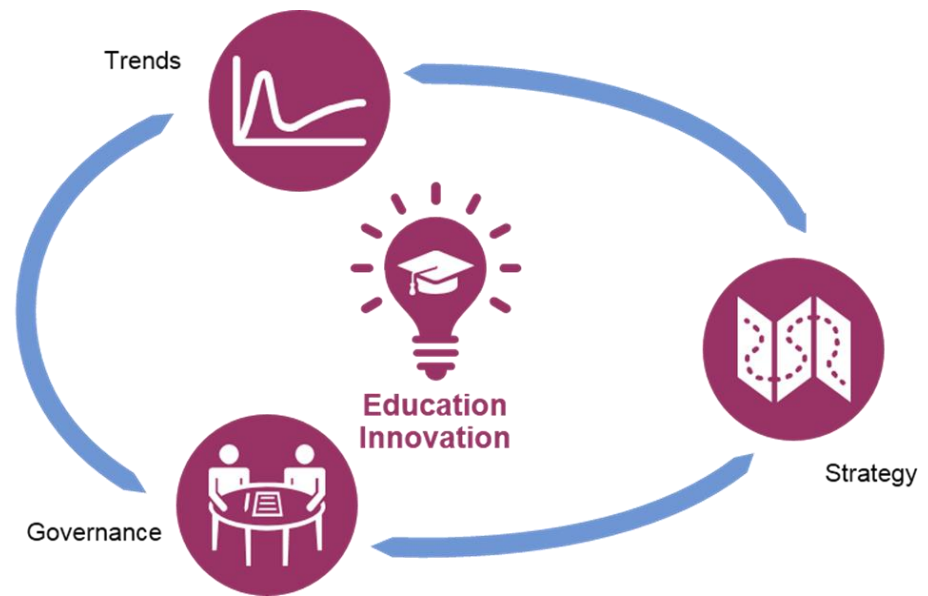|	
	Digital assessment refers to the application of digital technologies to create, administer, report and manage tests and examinations. Smart machines learn from experience without programmers writing feature-specific algorithms, and they can produce results their creators never expected to. Open educational resource (OER) ecosystems are pieces of educational content and media that are findable, freely available, and increasingly include tools and services to improve quality and production of open content. Listening and sensing technologies are a broad collection of virtual capabilities that range from social listening and sentiment analysis through capture and interpretation of social activities, such as tweets to technologies that operate in the IoT. Collaboration technology in this list is a sweeping definition of technology that facilitates research, education and outreach effectiveness for a team. It is certainly not a new trend or capability. However, it has increasing importance in a globalized online education ecosystem where many team members are geographically scattered. It is related to Gartner's "digital workplace research," which is defined as a business strategy to promote employee agility and engagement through a more consumerized work environment.
Sources	**Gartner Technology Prioritization Matrix for Education, 2016**

Gartner Technology Prioritization Matrix for Education, 2016

benefit	years to mainstream adoption			
	less than 2 years	2 to 5 years	5 to 10 years	more than 10 years
transformational		Adaptive Learning Platforms	Smart Machine Education Applications	
high	Cloud HPC/CaaS	Adaptive E-Textbooks Alumni CRM Citizen Developers DevOps Digital Preservation of Research Data Gamification IDaaS Institutional Analytics Learning Analytics Learning Stack Student Retention CRM	Big Data in Education Blockchain in Education Competency-Based Education Platforms Digital Assessment Exostructure Strategy Master Data Management MOOC Platforms Open Microcredentials SaaS SIS SIS International Data Interoperability Standards Virtual Reality/Augmented Reality Applications in Education	Li-Fi
moderate	BYOD Strategy E-Textbook Mobile Learning Smartphones SaaS Administration Applications Virtual Worlds Wireless as a Service	Hosted Virtual Desktop Services Integration Brokerage	Affective Computing Bluetooth Beacons Robotic Telepresence	Classroom 3D Printing Tin Can API
low				

As of July 2016

Trend #_4_	The Programmable or "App" Economy – digital business innovation creates disruptive effects that have a wide-ranging impact on people and technology. However, secondary ripple effects will often prove to be more disruptive than the original disruption. Digital strategists must actively identify secondary effects when planning change. An example is the astonishing rise of Pokemon Go (sorry, Chris) by little more than word of mouth — and the emergence of new marketing schemes based on augmented reality (AR) and virtual IoT "things." Pokemon Go's virtual internet monsters encourage us to look for unanticipated consequences of the rise of IoT.
Direction of Change for the next 3-5 years	• By 2020, half of large enterprises will be making business-critical decisions using discredited information. This is another unintended consequence of the pace of change being so high. With little ability to audit sufficiently the collection, distribution and vetting of data, it is inevitable that some discredited research or information will be consumed faster than our ability to recognize it as outdated, irrelevant or inaccurate. • By 2020, 100 million consumers will shop in augmented reality. • By 2020, 30% of web browsing sessions will be done without a screen. • By 2019, 20% of brands will abandon their mobile apps. • By 2020, algorithms will positively alter the behavior of over 1 billion global workers. • By 2022, a blockchain-based business will be worth $10 billion. • By 2021, 20% of all activities an individual engages in will involve at least one of the top-seven digital giants. • Through 2019, every $1 enterprises invest in innovation will require an additional $7 in core execution. • Through 2020, the Internet of Things (IoT) will increase data center storage demand by less than 3%. • By 2022, IoT will save consumers and businesses $1 trillion a year in maintenance, services and consumables. • By 2020, 40% of employees can cut their healthcare costs by wearing a fitness tracker. "*Top Strategic Predictions for 2017 and Beyond: Surviving the Storm Winds of Digital Disruption*" Gartner Published: 14 October 2016 ID: G00315910
Probability of change for the next 3-5 years	The college will need to continue to proactively manage its application portfolio in the context of "useful market life" (see Support Rationale) and look for opportunities to transition the student and employee experience from traditional higher ed platforms to consumer technologies (i.e.: SugarCRM and ActOn). **Strategic Planning and Governance** Being a leader in digitalization first requires a firm understanding of the education community "business" trends, as well as technology trends. The CIO must engage in building key business trends and relevant strategic technologies for both the institution leadership and the IT organization. This will create a sound basis for engaging in strategic planning and governance.

"*Executing a Digital Strategy in Education Primer for 2016*"
Gartner Published: 22 January 2016 ID: G00293008

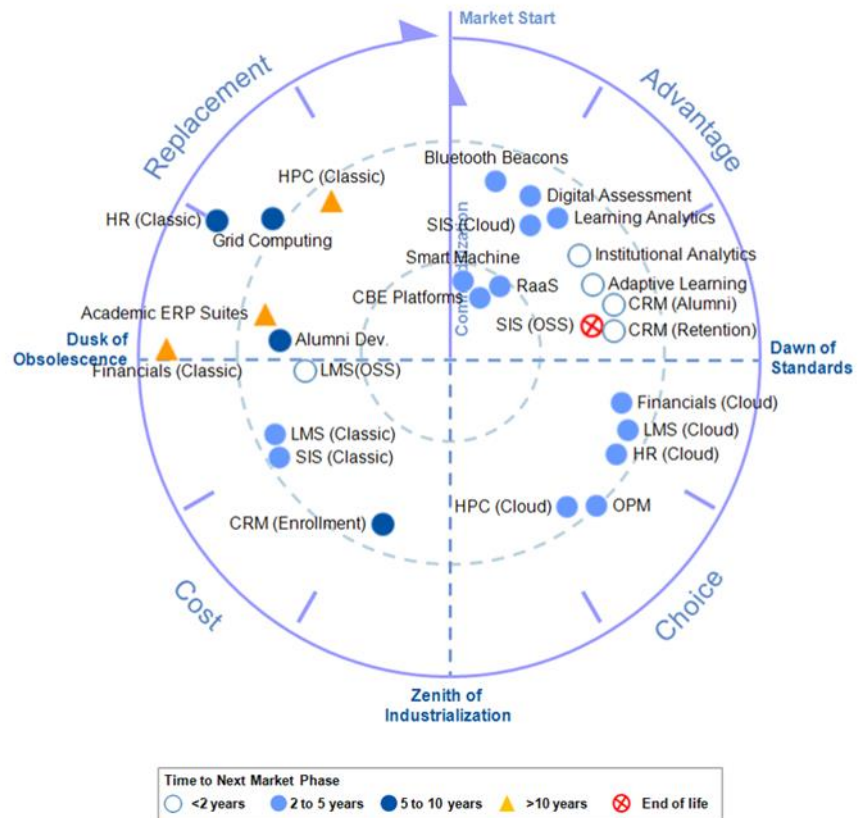| Opportunity or Threat	**SWOT Analysis of the Higher Education Industry in a Digital World** Strengths Higher education has many strengths; however, in a digital world, one key strength that it must leverage is the high brand value of institutions. This brand value has been afforded to institutions by reputation and given by accreditation. A second key strength is the collaborative nature of the industry. This is essential to succeed in the digital business environment. Already, the higher education industry routinely shares ideas, knowledge, and even code and solutions. The digital economy will challenge higher education to share with other industries — and perhaps even with competitors. Weaknesses The No. 1 weakness is the educational business model, which has not changed significantly in more than a century. It's institution-centric — based on enrolling students with the objective of turning them into full-fledged adults and critical thinkers — and sometimes appears to ignore the reality of student outcomes. Also, it's expensive — there are mounting issues with affordability that are intimately tied to the financial viability of some institutions. There is growing concern that higher education requires an abundance of resources in terms of people (faculty, administrators) and things (facilities, equipment), with seemingly inefficient processes resulting in tremendous costs to the individual consumer. In the current consumer-centric world, this institution-centric business model is, frankly, out of date. Today, people expect personalization in all aspects of their lives. Threats The No. 1 threat to the higher education industry is new competitors from adjacent markets. For example, Facebook announced plans to get into the

	education business. It is starting with K-12, but eventually plans to get into higher education. While its plans today are contained, this represents a disruption that starts at the edges of the business model — what Clayton Christensen calls "disruptive innovation." In another example, LinkedIn spent $1.5 billion to buy Lynda.com. Recently, it announced plans to offer free Lynda.com courses on some Virgin America flights. These two companies arguably have the largest social networks on the planet, and they are headed your way.

There is also the potential for higher education to be disintermediated. It is the threat of an outside entity educating not only others, but also its own employees. For example, Google has the capability to provide education and may have a true interest in it. Consider the possibility that it could decide tomorrow to educate all of its future employees directly — that is, take them immediately out of high school and send them to Google University. The idea really isn't that far-fetched.

Opportunities
The primary opportunity for higher education is to use today's (and tomorrow's) digital technologies to drive innovation and bring new value to the business model — and, in turn, the education industry. The essence of this opportunity is the ability to do recombination (that is, recombining services, products, skills and value propositions) — not only among education institutions, but also with others outside the industry — and to create new value.

"*Industry Vision: The Fluid University Will Succeed in the Digital Business Era*"
Gartner Published: 09 May 2016 ID: G00294487 |
| **Support Rationale** | **Useful Market Life**
For each technology asset class, market life is a relative measure of where the asset class currently sits within its own life cycle. Measures are stated using the metaphor of a 12-hour clock face, and the full market lifetime of delivery comprises one complete 12-hour cycle, from 12:00 to 12:00.

The market life comprises four phases:
• **Advantage**: From 12:00 to 3:00, during which time the market typically moves from emerging status to adolescent status. Levels of demand and competition are typically low, so the technology is procured for what it delivers, not for its placement in its own market.
• **Choice**: From 3:00 to 6:00, during which time the market typically moves from adolescent status to early mainstream. This is the phase of highest demand growth, when supply options should grow and prices should fall at their fastest rates.
• **Cost**: From 6:00 to 9:00, during which time the market moves from early mainstream status to mature mainstream status. Commoditization is at its highest level in this phase, and costs will be the strongest motivator in most procurement decisions. |

	• **Replacement**: From 9:00 to 12:00, during which time the market moves from mature mainstream status through legacy status and to "market end" (after which the technology is no longer viable to procure or use). Procurement and operating costs will steadily rise, and enterprises should seek alternative approaches to fulfill the business requirement. **Figure 1. IT Market Clock for Higher Education, 2016**
Sources	"*Top Strategic Predictions for 2017 and Beyond: Surviving the Storm Winds of Digital Disruption*" Gartner Published: 14 October 2016 ID: G00315910 "*Gartner's 2016 Hype Cycles Highlight Digital Business Ecosystems*" Gartner Published: 11 August 2016 Computer Associates Ads: http://www.ca.com/us/company/newsroom/press-releases/2016/ca-technologies-launches-new-tv-ads-that-capture-life-in-the-app-economy.html https://www.ispot.tv/ad/A5_m/ca-technologies-the-fridge "*Executing a Digital Strategy in Education Primer for 2016*"

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	"Industry Vision: The Fluid University Will Succeed in the Digital Business Era" Gartner Published: 09 May 2016 ID: G00294487