# Teaching That Keeps Pace With Technology

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## ABSTRACT

IT faculty members find it increasingly difficult to keep pace with rapidly changing software, hardware and networking technologies, let alone to introduce new course materials that adequately address the attendant IT management challenges. Yet, our students and their employers expect that our courses will address timely topics in the context of fundamental principles and skills. This paper discusses several examples of the rapid development of new courses and course modules covering emerging IT topics, which were designed for a variety of graduate degree programs at Bentley College's McCallum Graduate School of Business. Based on these experiences, suggestions are offered for blending relevant research into course materials on emerging IT issues. We conclude with lessons learned on how to: 1) leverage your research; 2) continuously scan for relevant emerging topics; 3) accept curricular imperfection; 4) collaborate with practitioners; 5) collaborate with and learn from students.

## INTRODUCTION

Some time ago, a magazine cartoon depicted a poorly dressed, unshaven man moping on a park bench. Two clean-cut joggers pass by. "Poor fellow," says one. "He took a two-week vacation and fell so far behind, he lost his IT job." He could as easily have been an IT faculty member in a business school. Take a short vacation — never mind a sabbatical! — and we return to discover that new hardware, software and networking technologies appeared on campus in our absence.

Who, as the last century drew to a close, could have taught about Bluetooth, WAP, Jini, or XML, to cite but a few examples of significant new technologies? Furthermore, new applications of these technologies, and new business models enabled by them, are also introduced at bewildering rates. Pre-millennium, the term Application Services Provider did not appear on MIS syllabi; today, we would be remiss not to discuss this important IS option. And, pity the poor faculty member who tries to keep up with electronic commerce developments! Consider, for example, the many high-flying dot-com darlings that failed in the 2000 and 2001 downturn.

These and numerous other IT challenges illustrate the strong pressure a faculty member faces to rapidly and continuously infuse new content into the business curriculum. Somehow business school CS, CIS, MIS and AIS professors need to keep pace with these changing developments, while retaining a focus on the core principles that provide a foundation for our students' ability to continue to learn throughout their careers.

To address this challenge, Bentley College has experimented with a "fast-cycle" research and curriculum-development process in many of our programs (Fedorowicz and Gogan, 2001). In a research-driven fast cycle, faculty members leverage their curricular efforts by judiciously selecting research topics and field studies that provide insight and material for classroom use. Fast-cycle development relies heavily on the input and feedback of curriculum stakeholders, such as students, alumni, current and potential employers, and benefactors. This article discusses several recent examples in which new courses or course modules were rapidly developed following a fast-cycle approach for various Accounting Information Systems (AIS) and Computer Information Systems (CIS) classes. Each example illustrates the link between the faculty member's need to acquire knowledge or skills in an emerging area and the production of high-quality research and/or teaching materials. This is especially important for emerging technologies, for which traditional textbooks or student materials do not yet exist. Following a description of each example, we discuss the lessons learned, provide some guidelines for succeeding with a fast-cycle approach, and close with implications for teaching and research.

## BACKGROUND: BENTLEY COLLEGE

Bentley College is a private school located outside of Boston, Massachusetts. Approximately 4300 undergraduates, 1400 graduate students, and 2300 professional and executive education students are taught by a full-time faculty of 360. Bentley has traditionally had a strong regional reputation for its undergraduate accounting and finance programs, and was one of the first colleges to require that all undergraduate students obtain a laptop computer. Shortly after the 1997 appointment of a new and very supportive president, the faculty and administration launched an ambitious set of initiatives to re-position the College as a "Business School for the Information Age." From 1998-2001 these initiatives have included a revamped undergraduate core curriculum, several new undergraduate majors, a new undergraduate IT minor, new full-time Information-Age MBA program, and five new Master of Science programs: Accounting Information Systems, Information-Age Marketing, Global Financial Analysis, Human Factors in Information Design, and Information Technology. Each new program has required a significant effort to redesign existing courses and introduce new courses that address the intersection of emerging information technologies, business processes, and best management practices. This paper describes five such efforts in our McCallum School graduate curricula.

# I. RESEARCH INFORMS CURRICULUM: Y2K PROJECT MANAGEMENT

Our first example portrays a program of research on Year 2000 (Y2K) Compliance Projects, which spawned a new IT project management course and several course modules on related topics. In 1996 both IT and accounting professionals were starting to play important roles in Year 2000 Compliance projects, but at that time it was difficult to locate detailed discussions of how companies were organizing and managing these projects. Examples of technical and managerial best practices were sadly lacking, and due to the short time span in which this arose and passed as a major area of concern, few if any teaching resources were to be found. To learn more, two faculty members conducted a large-scale case study at the New York Metropolitan Transportation Authority, which resulted in a teaching case (Gogan and Fedorowicz, 1998). The case was first taught in the graduate Accounting Information Systems course in spring, 1997 and then published with the teaching note for general consumption as an example of project management, change control practices, and IT risk management.

Further research on a variety of Y2K projects yielded several additional teaching cases and articles, each of which addressed a different facet of the problem (Fedorowicz and Gogan, 1997; Gogan and Beranek, 1999; Gogan, Beranek and Kanter, 1999; Gogan, Fedorowicz and Rao, 1999; Gogan and Rao, 2000). Based on this research, a graduate course was created, entitled "Managing Year 2000 Compliance Projects," which was first taught in winter, 1998. This interdisciplinary course, targeted at CIS, Accounting and Management students, employed a mix of case studies, hands-on exercises, and readings from accounting, IT and business periodicals. It was organized in five modules, as follows:

1. What is the Year 2000 Problem?
2. Assessing Y2K Project Risks and Readiness
3. Y2K Project Management Best Practices
4. Project Management Tools and Issues
5. Capstone Project

Guest speakers from industry addressed specialized topics (such as Y2K testing, legal issues, and software change control processes). In their capstone project, students evaluated actual Y2K projects at local companies. This semester-long Year 2000 Project Management course was taught twice: in winter and summer 1998.

By 1999, there was less demand for a comprehensive course on Y2K projects, since most organizations were well along in their Y2K compliance efforts. However, there was still significant demand for accountants and IT professionals who were skilled in two phases of these projects: system testing and contingency planning. To address that demand, a Y2K student project was created for use in an Advanced AIS class in which these two phases comprised a module. During the first offering of this course in Spring 1999, students were asked to analyze the Y2K implications of a specific business process and its supporting applications for a client organization. Students were directed to deliver contingency and testing plans to their client's Y2K team. The final deliverable, which was presented to a representative of the client Y2K team, was a report which included a description of the business process and its related tools and applications, its links to other business processes, its Y2K component, the process objectives and data gathering process, and the completed testing and contingency plans. In this manner, the students learned some valuable long-term skills and were able to apply them to a current widespread technology concern.

Another Y2K course module was created for a required MBA core course ("IT in the Business Environment") to teach the general MBA student population about such foundation principles as IT project risk analysis, change controls, and data quality. This Y2K module was taught in fall 1999 and later revised (as a module on "Project Management Lessons Learned from Y2K") for use in spring and fall 2000. Still later, these materials were repositioned for use in a module on "Managing Complex IT Initiatives."

Because the above example spans the longest time period covered by the examples in this article — 1996 to 2000 — it offers a comprehensive view of a fast-cycle process in which faculty research and curriculum development were tightly linked. In this example, faculty conducted field research at several participating organizations, yielding both research publications and teaching materials for use with the general MBA population and Master of Science students in Accounting Information Systems and Computer Information Systems. The faculty members became well versed in Y2K issues while producing several publishable studies. The time costs associated with acquiring enough Y2K knowledge to be able to teach the topic effectively were more than offset by the resulting publications.

In the next example, faculty research and course development were more loosely coupled. The instructor conducted research addressing Christensen's Theory of Disruptive Technologies, which provided an organizing framework for an MBA course module which has been designed to reflect the continuous evolution of hardware, software and networking technologies (Christensen, 1997).

# II. TRACKING A MOVING TARGET: DISRUPTIVE TECHNOLOGIES

The required MBA course on IT in the Business Environment is organized into four modules (approximately 3 weeks each):

1. IT Foundations (hardware, software, data, networks)
2. Managing IT Projects
3. Aligning the IT Mission and the Business Strategy
4. Spotting and Managing Disruptive Information Technologies

The fourth module, "Spotting and Managing Disruptive Information Technologies" helps students prepare for the challenges posed by rapid innovation in hardware, software, data and networking technologies, and is based upon Christensen's work on Disruptive Technology theory (Bower and Christensen, 1995). This theory addresses the radical organizational, operational, human resources and strategic implications of "disruptive" technologies as compared with the moderate, incremental impact of "sustaining" technologies. In addition to giving students a framework within which to evalu-

ate technologies they may encounter in the future, it also provides a good context within which faculty can assess the relevance of innovative technologies in the overall curriculum.

Two faculty members conducted field research that led to publications on disruptive Internet-based technologies (Gogan, 1996; Fedorowicz and Gogan, 1997). Based on this research, the new course module was developed. Students learn to assess the likelihood that a particular emerging technology will be disruptive, and to recommend appropriate changes in business strategy and operations, human resources policies and control mechanisms to adapt to (or profit from) the disruption.

Yesterday's disruptive emerging technology is tomorrow's familiar, established technology, which creates an ongoing challenge for the instructor. Although Christensen's theory is reasonably stable, the examples used in class needed to be as current as possible. The team assignment helped address this challenge. Each team was given the task of learning about a different emerging technology (or application) and preparing an in-class Disruptive Technology Briefing. In a 15-minute presentation, each team described how the technology works, actual or potential applications of the technology, their analysis of whether it is a disruptive technology, and strategic and organizational implications.

In fall 2000 the topics included were Jini, Wireless Applications Protocol, Bluetooth, W-CDMA, Napster, Gnutella, and Carnivore. Teams were informed that their task was to help both the instructor and their classmates learn about the emerging technology that they selected. Students who were on the receiving end were told that aspects of each presentation would be fair game for inclusion on the final exam. After each presentation, students submitted items to a Web-based course discussion board, offering follow-on observations or citing relevant news stories related to the use of these technologies. As promised, the take-home final exam did include questions related to the team presentations. The value of this exercise extends into future semesters, as the instructor (with students' permission) can adapt the best presentations for lec-

tures to the next generation of students. In turn, new students will investigate other emerging technologies for their projects. Students here are the stakeholders who contribute to defining the emerging technology content of the course, enabling continuous fast-cycle upgrading of course content.

The idea of having students focus an MIS course project on emerging technologies is not new; the authors are aware of many MIS professors who use this technique at other schools. However, we believe that the use of Disruptive Technology Theory as an organizing framework for the assignment is a fairly unique and very valuable aspect of the project. Each semester brings a new list of technologies to be examined, yet the key principles and evaluation criteria remain a solid foundation.

In the next examples, faculty drew heavily on practitioner stakeholders as resources as they developed new course modules. Faculty also learned to rely less heavily on their own expertise as they examined emerging topics in collaboration with their students.

## III. AN EMERGING BUSINESS MODEL: E-COMMERCE ASSURANCE SERVICES

In 1994 the American Institute of Certified Public Accountants (AICPA) proposed a strategic shift for accounting firms: expand beyond the traditional attest function to provide a range of new trusted third-party assurance services aimed at rapidly-growing markets, such as electronic commerce. In September 1997 the AICPA, in conjunction with the Canadian Institute of Chartered Accountants, introduced the first assurance service product, CPA WebTrust. Professional service firms (i.e., employer and benefactor stakeholders) strongly encouraged accounting faculty to introduce students to WebTrust and to assurance services in general. In response, one faculty member created a unique half-semester graduate course on E-Commerce Assurance Services, using as its primary text a set of teaching materials on WebTrust from the AICPA. The course description stated:

"*Accountants need to be aware of the risks and appropriate controls for a vari-*

*ety of electronic commerce activities. To serve as a business advisor or as a trusted third-party provider of new types of e-commerce assurance services, accountants should be able to:*

- *Identify emerging technologies for e-commerce, understand the new opportunities that they offer and new risks that they bring, and forecast their assimilation;*
- *Assess technical, economic, and operational viability of e-commerce efforts;*
- *Assess threats to transaction integrity, to the security of an organization's financial and information resources, and to customers' and employees' privacy; and*
- *Address ethical, legal, and regulatory issues in e-commerce assurance services.*

*The course teaches students how to identify relevant business, technical, legal and professional issues in electronic commerce, and how to design and conduct an e-commerce assurance engagement, including recommending appropriate mechanisms to control risks and to increase the likelihood of beneficial outcomes. Non-accounting students who expect to be involved in e-commerce as providers of online goods and services also benefit from this course, by learning how alliances with trusted third-party 'seal of approval' programs can help preserve customers' confidence in firms' trustworthiness.*"

When first offered in Spring 1999, this was the first graduate E-Commerce Assurance Services course in the nation. By that time a new MS in AIS program had been launched; this course became an advanced elective in that program. The course was organized into six modules:

1. E-Commerce Trends
2. New AICPA Assurance Services
3. Other E-Commerce Assurance Providers
4. E-Commerce Security
5. Implications of Emerging E-Commerce Technologies
6. The Future of E-Commerce Assurance

Students made extensive use of the web sites of the AICPA, Better Business Bureau, TrustE and other organizations, and

guest speakers helped to fill the gaps in the instructor's knowledge of this rapidly changing new field. A packet of readings included items drawn from a variety of accounting, business, and IT journals.

This example illustrates the need to consult closely and frequently with practitioners to ensure that curriculum changes reflect activity in the intended professional area. This instructor was able to draw upon practice and published practitioner materials to quickly fill a gap in the curriculum, one which continues to emphasize issues and skills in high demand at most professional service firms.

## IV. A TIMELY CONSULTING OPPORTUNITY: SOFTWARE QUALITY ASSURANCE

The next two course modules were designed as components of the graduate Advanced AIS course, which is intended for students who plan to work as accounting or IT professionals. Graduates are expected to be able to help management use IT to control the execution of business activities effectively, while capturing accurate and complete data about those activities in real-time. This course is organized into seven modules:

1. Introduction: state of the art, state of the profession
2. Data Quality
3. Systems Development and Software Quality
4. Enterprise Systems and Business processes
5. Emerging Technologies: XML and XBRL
6. Financial Business Intelligence and the data warehouse
7. Course Wrap-up and Project Presentations

In the course, students model and analyze business information systems and acquire skills in documenting and measuring compliance with user requirements, communicating outcomes, and supporting decision-making with enterprise software such as SAP. A large-scale project enriches students' experience with and appreciation for the opportunities and challenges posed by emerging information technologies. Another major objective of the course is to introduce students to is-

sues involved in specifying, measuring and evaluating the quality of software and the data on which it operates.

In fall 1999 the instructor worked with an enterprise software vendor to obtain a beta (pre-release) version of enterprise software that was targeted at professional services firms (such as architects and lawyers). A project was designed to give the students experience with establishing quality metrics and evaluating software against those metrics. Each student team was assigned a module from the software package. They were instructed to first briefly document their assigned module, then to design appropriate software quality assurance metrics and measures for that module (based on guidelines offered in their software quality textbook). Students then created a test plan to evaluate these metrics and measures, and tested their module. Finally, they prepared a report which documented the bugs that were identified, offered insight on other issues (such as usability of the software module), and discussed their assessment of the quality of the software. The students met frequently in the Accounting Center for Electronic Learning and Business measurement (the ACELAB) where they made use of group study areas to work collectively with their software module. (See Figure 1.) The teams presented their

findings to the Director of Client Services and the Director of Application Development for the software vendor. The company representatives asked challenging questions, and were pleased to bring back extensive feedback on the usability of the software and the beta test results, which were then incorporated into the next release of the product.

From the instructor's perspective, the vendor's involvement helped to provide students with high quality and immediate feedback on their projects. In this case, the vendor provided both the guidance of a stakeholder in crafting a valuable and current experience for the students, as well as volunteering the software expertise to assist the student groups in understanding how each module functioned. In essence, the responsibility for deep knowledge of the software application was accepted by the stakeholder, so the students and instructor were not forced to learn the software on their own.

## V. AN OPPORTUNITY TO HELP DESIGN AN EMERGING STANDARD: XBRL

A well-designed course can be changed mid-semester to incorporate late-breaking technology opportunities. In this example, the instructor became aware of an opportunity and quickly adjusted the course syllabus. At an early March 2000 meeting of an executive committee for the AICPA (of which the instructor was a member), a presentation was made on an important new business-reporting taxonomy. Labeled XBRL (for eXtensible Business Reporting Language), this taxonomy (which is based on the Extensible Markup Language, or XML) is currently under development by a consortium of software vendors (including IBM, SAP, Oracle, Microsoft and others)



**Figure 1.**

national and international auditor associations (e.g., AICPA) and other parties who are involved in the creation and dissemination of business information (such as Fidelity, Inc. and Moody's). The instructor suggested to the head of the XBRL Project Committee that Bentley Advanced AIS students could contribute to the XBRL evaluation process to illustrate the changing business reporting and intelligence demands placed on enterprise systems. The invitation was accepted, and a project was designed in which students would evaluate the first draft of the XBRL proposal that had just been published on the Project Committee web site (www.xbrl.org). The head of the XBRL Project Committee came to class two weeks later to present an overview of XBRL and answer students' questions, again acting both as a professional/stakeholder and an ongoing class resource for the project groups.

Student teams addressed either a technical or managerial aspect of XBRL. Those choosing the technical aspect reviewed the proposed standard and gave feedback in line with guidelines provided on the XBRL web site, and/or submitted several footnotes for inclusion in the published taxonomy. Since XBRL is defined in conformance with XML, these students first needed to learn about markup languages (such as SGML and HTML). The managerial option focused on the implications of XBRL for users of financial information. Teams were asked to provide examples, hypothetical scenarios, or data on the potential savings and value-add that XBRL brings to the business reporting supply chain. Each team focused on one of the following groups:

- Assurance services (other than financial statement auditors)
- Financial services (e.g., brokerage firms, NASDAQ and other markets)
- Investment Banks
- Commercial Banks (e.g., loan officers)
- Institutional investors (e.g., fund managers, portfolio managers)
- Individual investors (e.g., individuals, National Association of Investment Clubs, American Association of Individual Investors)
- Independent Software Vendors (Great Plains, SAP, Peachtree)
- Regulators (e.g., SEC, Edgar)

- Data resellers (e.g., Reuters, First Call)
- Customers or vendors who investigate the financial condition of a partnering company within their own supply chain

Students presented their findings in class and submitted their reports directly to the XBRL Project Committee. In fall 2000, the Committee announced an international competition to encourage further student feedback to the process, effectively encouraging other instructors to adapt courses to include XBRL. The XBRL committee currently comprises 85 international firms and professional organizations, and is well positioned to become the business-reporting standard for Internet communication. This example shows how a late-breaking innovation can be tapped in a course even as it is being publicly released. In this case, there would have been no way to plan ahead for this project, since the committee had not progressed sufficiently before the beginning of the semester to define a workable set of activities. Given the fluid nature of this innovation, relying on the innovator/stakeholder to provide both depth of expertise and the overview lecture made it feasible to adapt the course midstream.

## LESSONS LEARNED

What have we learned from these and other experiences with teaching emerging technology topics? We derived five lessons learned:

- Leverage your research;
- Continuously scan for relevant emerging topics;
- Accept curricular imperfection;
- Collaborate with practitioners; and
- Collaborate with and learn from students.

*Leverage your research*: The first two curriculum development examples in this paper illustrate how faculty research findings on emerging topics can be drawn into the curriculum. In the Y2K Project Management example, research and curriculum were tightly linked. The first output of the first field research effort was a teaching case, and subsequently additional teaching cases, conference proceedings and journal articles were pro-

duced. In the second example (Disruptive Technologies), research and curriculum development were loosely linked. While the faculty research did not produce teaching cases directly for this module, it did yield a robust organizing framework.

*Continuously scan:* For those of us who teach topics that are at the intersection of IT and business practice, it is essential to continuously monitor the environment to see what new developments might have a potential impact. Luckily, there are many avenues through which this can be accomplished. The trade press, web site portals, trade shows and many list serves will orient you to the newest technologies and best practices that industry has to offer. This is one area where industry leads academe. Public awareness of and dissemination of information about industry innovations and trends greatly precedes any academic research publication about it, and much of it is freely accessible.

*Accept imperfection:* A frequent complaint about adapting curriculum is that the instructor is uncomfortable teaching about something s/he has not had considerable experience with outside of the classroom. Keep in mind that with brand new technologies or applications, almost no one has significant IT experience. Whatever you can include in your class will give your students a head start in their careers, and also teach them to monitor the environment for potentially important phenomena. There is no curricular reason to wait until you're an expert on a topic before exploring it alongside your students.

*Collaborate with practitioners*: One way we have been successful in introducing students to topics with which we have insufficient knowledge is to use external stakeholders extensively. Practitioners from recruiting firms, from vendors, and others are very interested in meeting your students and sharing their experiences. Trade shows and local chapters of professional organizations are good places to meet potential speakers. Your career center may also be able to link you up with corporate representatives. Perhaps the best source of all is the college's alumni, who frequently enjoy an excuse to revisit the campus. Bentley College has also successfully partnered with many

software and hardware vendors to provide state-of-the-art technology labs for student use and faculty research support. Figures [2] and [3] show how students work in the classroom environment of the Center for Marketing Technologies and the Trading Room, respectively.

*Collaborate with and learn from students*: Another useful technique for keeping up with the rapid pace of technology change is to enlist students' help in investigating new technologies. This can take the form of student research presentations, self-instruction of new software, or consulting projects for real clients. The student garners research and presentation skills, and the instructor gets material to support the next iteration of the course.

With so many advances in technologies and so many changes in business models, the IT instructor has no choice but to change curriculum frequently. Sometimes this means introducing new modules in courses, or new projects to illustrate theoretical concepts, or, in many cases, entirely new courses need to be developed. As instructors, we must be able to learn and adapt at the same pace we expect our students to keep up with what's happening in the business and technology environment. We need to embrace change and create opportunities to learn from it and to benefit from it in our teaching and research.

## IMPLICATIONS FOR RESEARCH

In a broader sense, our definition of what constitutes high-quality research also needs to change to reflect the complementary activities of research and curriculum development. The definition of "scholarship" may need to be revisited and collegial norms changed. Many faculty believe that research is not "scholarly" unless it is deterministic, quantifiable, and theory-driven. Field research that is action-based, interpretive, and inductive may be viewed as less worthy of colleagues' respect, despite ample support in the literature (Orlikowski and Baroudi, 1992).

The university needs to support faculty efforts toward documenting and understanding phenomena that can easily be adapted to classroom use. As a result,

mechanisms for funding faculty development, research, and curriculum may need to be revised to reduce artificial barriers between "research" and "curriculum." Traditional means of evaluating and approving curricular changes may prove too conservative and time-consuming. In order to rapidly capitalize on research and curriculum development op-


**Figure 2.**


**Figure 3.**


**Figure 4.**

portunities, flexible mechanisms are required. Research-driven and stakeholder-driven fast-cycle development methods give faculty the added incentive to couple research and teaching concerns.

A good example was the joint creation of a Master's degree offering in Human Factors in Information Design that is built around a research facility known as the Design and Usability Testing Center. Figure [4] show the control room in which usability analysis is studied. In this facility, faculty can conduct research on software usability, students can learn how to conduct usability tests, and software vendor partners can consult about the quality of the software they are developing. It's a win-win-win situation for all parties, since the students learn valuable skills while performing analysis on real software products in support of faculty research. Although this lab represents a fairly extensive technology investment, similar synergies can result from alliances with software vendors who supply free copies of software for academic purposes.
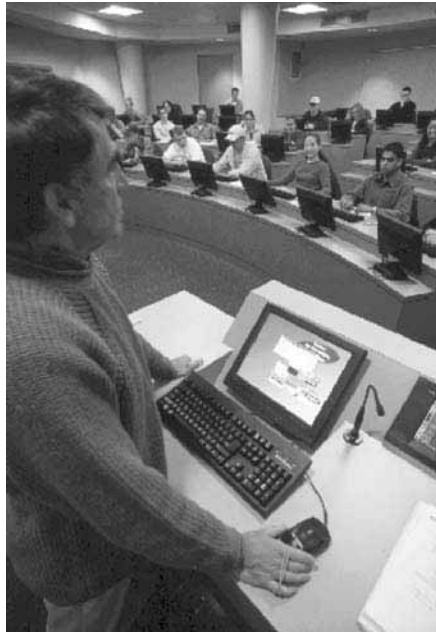
## CONCLUSION

We, as instructors, can choose to regard the pace of change in the IT world as an insurmountable challenge or an incredible opportunity. This article tries to meet the challenge by creating opportunities for instructional innovation that educates the instructor as well as the student, provides research leads and publications, and demands more active participation on the part of the student. We include a broad range of examples of how emerging technologies can be quickly incorporated into existing courses or serve as the basis of new course offerings. With these examples, the reader should be able to extrapolate how the next round of IT innovation could be harnessed to better prepare future graduates.

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