Tablets, Apps, and the University: A Rationale for Establishing App Development Centers

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Abstract

The advent of the mobile tablet device represents an ecumenical consilience that heralds new possibilities for scholars and scientists to develop and share their research worldwide. The concomitant arrival of electronic bookstores and, in particular, apps and embedded advertising, presents faculty with a new research paradigm that is poised to transform traditional avenues of dissemination, professional advancement, and collaboration. It may also present universities with the opportunity of establishing a new research ecosystem founded on a sustainable business model and spearheaded by app development centers. To fully exploit this new technology, university administrators will have to develop a new institutional mindset about the way they evaluate academic productivity and allocate intellectual capital. Just as in 1878 it was high time American universities began founding university presses, 2011 may be the year to begin thinking about establishing university app development centers.

Keywords: app development center, digital critical edition, intellectual capital allocation, iPad, university, research, tablet.

1   Introduction

At the turn of the millennium it may have been difficult to foresee an impending wedlock between books and television. A decade later we may finally declare that espousal consummated with the advent of the iPad, a device that represents the locus of perhaps the most ecumenical consilience history has known. The word processing software of desktop computers and their laptop cousins was designed to replace typewriters and has always privileged composing rather than deciphering text. Now we hold in our hands a device designed to do both and much else, even if its usefulness, at first glance, seems to reside more in consuming than in producing knowledge. Sitting back on our easy chairs we hold a mobile device the convenient size of a blockpad with which, by sliding and tapping our fingers across its screen, we can purchase a book from an online bookstore and in seconds tap it open and read it. If the book was not highly readable on television or desktop screens, it turns out that television is highly viewable in the book, which is to say, in the new computing form factor the iPad has inaugurated: the mobile tablet device.

2   *Dead tree books.*

For now, dead tree books retain the charm of familiarity. They are discrete objects of particular weights and dimensions, with distinct covers and spines, which we read and keep in our offices and around the house. If our personal libraries are not overlarge, we can usually locate the title we're looking for. Printed books are stable, self-contained objects whose use, given sufficient light, requires no more energy than what is needed to hold them in our hands, no more technique than knowing how to read and turn pages. In that sense, they are "backwards compatible to the dawn of the English language" (Mims 2010). Books are almost by definition authentic objects, all the more so if signed, inscribed, or dedicated by their authors. Hardbound or softbound, the mere sight of a book may bring back fond memories of the last time we flipped its dog-eared pages, highlighted favorite passages, or read it on vacationsomewhere. Yet, whether we leave the book to gather dust or not, whether printed on acid-free paper or not, its treasured smell, look, and feel is beginning to take on the aura of a collectable. Friends with substantial home libraries who have purchased Kindles and iPads and similar devices are beginning to do away with their holdings by selling them on eBay and at garage sales, relegating the leftovers to the garbage heap.

Here I want to refer to a passage in Jonathan Culler's *Framing the Sign*, which I have in one of the bookshelves downstairs, but prefer to consult Google Books to save myself the trouble of going down there to look for it. Seeing that Google offers neither a limited preview nor snippets of *Framing the Sign*, I head for the bookshelves, locate it, and peruse the index, in search of "junk" and "rubbish." Neither word is listed. The table of contents does show a chapter in part III called "Theory of Rubbish." No automatic word search is possible, so I must skim through most of the chapter before landing on the passage I was looking for: "The possibility of change [from transient to durable] may well lie in junk and rubbish and in the mechanisms whereby the transient and functional may, when reduced to rubbish, be discovered and become durable" (Culler 1988). This, indeed, is the process books, including *Framing the Sign*, are about to undergo or are already undergoing. Their functionality, which once seemed so lasting, is turning out to have been temporary, and the passage from functionality to rubbish to collectable undergone by out-of-print books may soon be the fate of most printed books. How quickly this transformation will take place is hard to determine. I expect that, by the time they are adults, children born today may still be fascinated by the quaintness of printed books—just as we are impressed, in the age of emails, Tweets, Facebooking, and text messages, when we discover a hand-written letter or postcard in our mailboxes. Dead tree books, a fairly stable commodity since Gutenberg, may be about to go the way of antique candleholders and wax candles, useful only when the electricity goes out.

3. Technical features of the computer and the Internet (designed neither by nor for scholars)

Since the advent of the personal computer, scholars and researchers have benefited from many of the key features that took it beyond the typewriter and the calculator, including easy editing, copying, cutting and pasting, word searching, spellchecking, and archiving. Word processing software was of course not designed by scholars or researchers, nor were they ever consulted about what features might be useful to them and perhaps even to the general public. This decades-old oversight is a product of the great divides that have long existed and still exist between the humanities and the sciences (in particular, the computer sciences), as well as between the arts and sciences on the one hand and information technology corporations on the other. Adding features like word count, compare documents, and track changes to the word processor took a while. So did built-in dictionaries and thesauruses. Thirty years after its advent, the standard word processor of today still does not offer a simple but useful deciphering feature, namely, the option for presenting a sortable word frequency list of the "processed" text.

A similar state of affairs has affected the development of the Internet and most websites. Unexpectedly, Google Books does now offer word-frequency analyses of many of the millions of books it has digitized and placed online, but the results are not presented in a sorted list, nor in lists that take into account parts of speech, despite artificial intelligence advances in this last area. Rather, the results are presented in a paragraph-sized word map in which the most frequent words are shown in a larger font size than their less frequent neighbors. The information is therefore readily available, and someone at Google has even thought of presenting it in a visually appealing way. But if we want to know the actual numerical count of a common noun in a 500-page novel to compare it with that of the count of another common noun in the same work, we must still acquire the digital text and the software to analyze it on our own.

Together, the Internet and digital media have given humanists and scientists countless opportunities to improve the efficiency and even the depth and breadth of their research, yet many of these opportunities have fallen by the wayside and, curiously, what opportunities we now enjoy are not here because we lobbied for them, but because technology has advanced of its own accord and deemed them useful to the average consumer, which is to say, useful in gaining competitive advantage and market share. The MLA and PsycARTICLES and similar discipline-specific databases are fine examples of opportunities well taken, even as the leviathan of search engines threatens to outperform them all with Google Scholar.

4. The iPad

Over the last decade, what digital tools for scholarly analysis and collaboration have been developed are to be found in websites, pioneered by a few determined individualsacross the globe. This has meant that researchers, students, scholars, and consumers of information have had to sit at their desks with a mouse and a keyboard to derive any benefit from them. Until last year. If it used to be that consuming rich digital text was an activity restricted to desktop and laptop computers, now the text and the worlds it may be linked to respond to the digits of the hand, to the swipe of a finger across a lightweight tablet.

And if it used to be that most of us were loathe to read more than five or ten pages at a time on our computer screens, tablets now make it possible to read with the same ease and comfort with which we have always delighted in reading dead tree books. Tablet computing profoundly changes the ergonomics of electronic reading, freeing us from hunching over a stationary object. The iPad's high-definition screen (higher than desktop and laptop screens, and therefore easier on the eyes), like the printed book, is finally at the service of our bodies rather than the other way around.

From among the various tablets and electronic readers now available (Galaxy,iPad 2, Kindle, Nook, PlayBook, TouchPad, Sony Reader, etc.), the iPad merits special attention from scientists and scholars.[1]The iPad is not merely an electronic reader, but a platform that incorporates an entirely new class of operating system. On the iPad 2 we can not only download and comfortably read books from the iBookstore, Amazon, Nook, and other electronic libraries, but we can also view photos and watch movies and television, edit film, make phone and video calls, send and receive email, listen to podcasts and music, text-message, write and edit documents, create and manage databases and spreadsheets, produce slide presentations, locate ourselves via GPS, play games, synchronize our calendars and contact lists, and access the Internet. All at our fingertips, anywhere we might be and all in what David Carr calls "an intimate way" (Carr 2010). As if this handy tablet of consilience were not bountiful enough, we can also download any of hundreds of thousands of curated apps expressly made for it and for the iPhone. Curiously, few of these apps are made by or for scientists or scholars. What might scientists and scholars do to exploit such a device?

5 A new business model.

Historians can, for example, embed maps, film, sound clips, photos, hypertexts, and interactive timelines in their narratives. Among others, the University of Houston has done just that in its Digital History website (2010). But note that this is a website, not an app. Although the site is nicely hierarchical and easily navigable, the narratives themselves are not embedded with hyperlinks or annotations. Nor are they extensive. This last aspect makes sense. Its designers—like all experienced webmasters—know that users are not disposed to sit long, merely reading (and not otherwise interacting with) text in front of their computer screens. Web designers purposely build their sites to be user-driven, and reading alone does not entail much driving, which is to say, mouse clicking and keyboarding. Textbook publishers have likewise been aware of this nontrivial detail and, until the advent of the tablet, have had the further disincentive of not knowing how to earn revenue from delivering rich electronic text via a medium that most of us expect to be available for free.

In other words, the job never got done because few of us wanted to read long articles or books on our computer screens and because no viable business model existed to support it.

Authors have long faced the same predicament. Why should a professor of biology or economics or any other discipline spend countless hours creating a content-rich website with no mechanism for compensation? Creators of such sites are usually unable to sell access to them, receive little institutional help in overcoming the technical hurdles associated with full-blown multimedial site development, andreceive scant recognition for authorship, since annual faculty evaluations tend to place a much higher premium on refereed articles and dead tree books published by university presses than on anything "published" in some new-fangled website.

The advent of the iPad and its imitators heralds not only a new mobile device but also a new business model, accessible to publishers and authors alike. The first sign of change came with the appearance of the iBookstore, from which in a few seconds we can download books that, at the tap of a finger, display the dictionary definition of any word we touch (for the moment, mostly in English, although what promises to be ecumenical about these devices is that they are being sold worldwide). Among the current features of iBooks are word searches, bookmarking, and the option of highlighting or annotating any portion of text. A list of highlighted, bookmarked, and annotated items then appears alongside the table of contents, from where, with a tap on the screen, we can navigate directly to any highlighted, bookmarked, or annotated text.

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[1] On its release in April 2010, the iPad essentially created a new product category, which it has continued to dominate to the present day. One of its advantages, aside from market penetration, is the vitality of its ecosystem. As of July 2011, there were 250 tablet-specific Android apps, while the Apple App Store boasted 90,000 designed specifically for the iPad (Donnell 2011).

While these useful features (especially, word searches) are not in themselves revolutionary, they are already handier than what we can do with printed books and they show that iBooks themselves are interaction- and hyperlink-capable. More importantly, they are available in a form and venue that bears little resemblance to a website, namely, as product for sale in a store. Apple controls both the iBookstore and iBookfeatures, and may expand those features to include richer text and hyperlinks as it sees fit (it already includes color illustrations and a few interactive editions for children). The same can be said for Amazon and its Kindle Books, as well as for Nook and other electronic book providers. But whether or not any of these providers expands the features of its products, scientists and scholars alike should not overlook another iPad feature, already familiar to a hundred million iPhone users: the App Store.

In it, content creators can offer any product that meets Apple's standards for iPad apps and offer it free or for a price, retaining seventy percent of the proceeds. Theodore Gray's *The Elements: A Visual Exploration*was a prime and early example. It brings the periodic table alive in ways probably never dreamed of by Mendeleyev, and offers versions in French, German, and Japanese. Another example is one of the most-installed apps in the category Education (which, strangely, contains the subcategory Books, as distinguished from iBooks).Called*Shakespeare*, it is a cooperative project between Readdle and PlayShakespeare.com. This latter site, administered by Ron Severdia, claims to be "the ultimate free Shakespeare resource" and is populated with the complete works of the bard as well as reviews of performances, blogs, podcasts, and the like (Severdia 2011). Severdia has adapted to the paradigm shift rapidly and almost seamlessly, by moving from a free access website to offering a product that resembles the website but whose professional version is available for download at the App Store for a price. In both examples, *Shakespeare* and *The Elements* ($13.99), the new business model is clear. Content creatorsand developers —researchers, educators, authors—can now combine assorted media into an app and offer it in the App Store, either for sale or free of charge. (Android tablet development is following a similar course, with Microsoft expected to do the same.) Developers can also, if they wish, participate in Apple's international iAd program to derive additional revenue from placing multimedial advertising in their apps.

5.1 Tablet critical editions

Although app offerings are rapidly growing even as features of current apps continue to expand, there is ample room for improvement. The current *Shakespeare* app, for example, does not offer critical editions. This may be because it is derived from a free access website, albeit a highly ranked one. Even after the advent of laptops and netbooks, the printed critical edition has remained a handier instrument of scholarship than most online editions. But the digital critical edition is now poised to upend its printed forbearer. As an app, it will be palpably easier to use, more versatile, and considerably more useful, since there is practically no limit to the annotative, hypertextual, and multimedial content that can be embedded in or linked to a text. Nor is there any limit to the collaborative networks and access protocols that can be established to nourish it. Amid the proliferation of online digital editions of literary works of every kind, the *critical edition*—that authoritative, carefully selected, edited, corrected, and annotated text on which students and scholars have always relied to conduct primary research— remains an elusive and relatively unexploited artifact. At a time when Google Books, Biblioteca Cervantes, Project Gutenberg, and similar initiatives are digitizing every book ever published, the prospect of devising a collaborative interactive app that will take full advantage of the digital age to produce electronic critical editions is now within reach. While the global and local search features of Google Books have already rendered that other tool of literary scholars, the printed concordance, obsolete, the same cannot be said of printed critical editions.

Despite their widespread use throughout the literary halls of academia, printed critical editions have always suffered from certain inherent limitations: 1) they are usually edited by a single scholar, without direct input from the community of scholars specializing in the author's work; 2) the number and extent of footnotes is limited by page size;[2] 3) the bibliography is never exhaustive and, more importantly, out of date by the time the edition reaches bookstores; 4) the manner of notifying the editor that an error has been foundis not always apparent; 5) even when the editor is aware of them, errors remain in the edition forever, unaddressed until the publisher decides to launch a new edition—which, if ever, may not be for another decade and may well introduce new errors; 6) annotations cannot be amended, nor new annotations added, except in subsequent editions; 7) there is no collaborative mechanism for adding or amending annotations; and

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[2] Many pages of critical editions of major works like *Don Quijote* or *Moby Dick* contain more footnotes than primary text.

8) direct linkage to related media (other editions, precursor manuscripts, photos, movie and sound clips, articles, and the like) is impossible.

Despite these substantial drawbacks, printed critical editions could, until now, claim superiority over online editions not only because of the comfort and convenience we associate with sitting back and reading a dead tree book, but also because the book-selling business model has worked without a hitch ever since Gutenberg sold his first indulgences for the Church in 1454. After the advent of mobile tablet devices like the iPad, these claims no longer hold.

Tablet critical editions could not only eliminate every one of the eight limitations just listed, they could also add features the printed book cannot match. These features include the ability to submit annotations on the fly, with one tap and in real time; assigning distinct levels of access to various communities of readers, reviewers, and editors, or open access to all users; one-tap electronic error reporting; flip-of-the-page display of digital and manuscripted editions; and one-tap submission of bibliographical entries to a searchable and constantly updated and expanding database. There are no medium-imposed restrictions on the number and extent of annotations that may be included, nor on who might participate in submitting them or be empowered to approve, amend, or reject them. Nor is there any limit to the kind or extent of digital media to which any portion of a critical edition may be linked. These and similar attributes, when combined with the mobile tablet's ease of use, comfort, and the new business model its apps introduce, promise to make electronic critical editions several orders of magnitude superior to their printed ancestors.

A similar promise of knowledge-consilience is available not just to those who work with critical editions of novels, essays, plays, and poems, but also to those who work with intellectual property and scientific research in sundry disciplines. Historians can follow in the footsteps of what theUniversity of Houston has done in its Digital History website and focus their efforts on producing media-rich and user-friendly apps related to their own specialties (University of Houston 2010). Chemists can incorporate in their apps atomic mass calculators, Bohr models of the atom, electron shells, glossaries, and much else. Physicists can bring to life the principles of fluid mechanics, acoustics, and thermodynamics. In medicine, a few possibilities are already being explored—Stanford University has distributed iPads to all its incoming medical students; (White 2010)—while the possibilities in many other disciplines, from psychology to civil engineering, are likewise wide open.

5.2 Obstacles

Despite these promises, two substantial hurdles will have to be overcome by anyone wanting to take full advantage of the latest technology. One resides in the term I just used, "latest technology." While the dead tree book is saddled with many limitations—most of them now overcome by the tablet—it will not be easy to render obsolete one of its key attributes, mentioned earlier: stability. The book and the technology needed to read it are eminently stable. The book is its own instrument. It is a self-contained object that, to enjoy its contents, requires the same technology in 2010 as it did in 1610, which is to say, nearly none. That cannot be said of apps, let alone media-rich apps. Neither is self-contained and both require an extremely sophisticated instrument for presentation, manipulation, and consumption. What is more, the development of an app requires considerably more skill to develop than what is needed to set type and operate a printing press.

As we move to HTML5, it is abundantly clear that the Internet itself, which has changed its protocols many times since it was instituted, will continue to change. Rapid and apparently never-ending change in technology means that a product released today may be unusable tomorrow, whether because of changes in the Internet, in the platform's operating system, or because the platform itself has been outstripped by new technology. This in turn means that apps and similar products, even if they are robust and bug-free on release, will require constant tweaking, maintenance, upgrading, and, on occasion, complete overhauls if they are to remain viable and retain their usefulness beyond a few years. (Librarians who tend to think in terms of centuries rather than years are all too familiar with the problem digital media bring to document preservation.) The skills needed to produce and to maintain apps and their future offspring or replacements will require constant honing. The other no less daunting hurdle that must be overcome is that most of us are neither programmers nor application developers, and until technology advances to the point where creating interactive multimedial content requires no knowledge of Objective-C and other programming languages, we will have to rely on forging alliances between computer scientists and ourselves, if we want to exploit the technologies that Apple and its competitors continue to leave on our doorsteps. How might we do this?

6 Universities and business.

There is no private or public entity better positioned to exploit app technology than the university. This is because it already houses ideal content-providers (in arts, engineering, letters, medicine, sciences), qualified technicians (in computer sciences, electrical engineering, and information technology staff), potential marketers (business colleges) and early-adopting consumers available for test marketing (the student body). In theory, the built-in advantages universities wield describe an app development ecosystem no enterprise can match. So why are university institutions slow to make the most of it? In part, precisely because they are institutions. Even Stanford University, which perhaps because of its geographic proximity to Apple Inc. was first to offer app development courses (it did so for the iPhone, before the iPad was released),[3] lacks a dedicated facility or administrative policy aimed specifically at fomenting collaboration between its computer sciences department and other disciplines. Stanford University is nevertheless beginning to release apps of the sort that concern us here. Late last year, for example, its Anesthesia Lab released "StanMed," an educational iPad app designed to be used by Stanford University's medical students, residents, fellows and faculty. "We intend StanMed to be used in the classroom and at the bedside. StanMed will provide clinically useful educational modules, tutorials, videos, podcasts and cognitive aids to help facilitate learning at the point of care" (Stafford 2010).

Across the Atlantic, the University of Kent has developed the "Centre for Journalism" appto showcase the multimedia efforts of its journalism faculty, staff, and students (Reeves 2010). As these and other university-generated apps begin to trickle into Apple and Android stores, universities might do well not to turn a blind eye to the leap in technology this impending medium migration represents. Instead, they might want to take full advantage of it. Doing so will entail more than simply asking IT wizards to design apps for touring the campus, for reading campus newsfeeds, for viewing class schedules, and the like (many universities have such apps now, in various states of development and in various degrees of sophistication). To fully exploit the technology among faculty, universities will first have to make substantial adjustments to their institutional mindsets in three areas: the academic reward system, interdisciplinary collaboration, and intellectual capital allocation.

6.1 Academic reward system

The faculty reward system universities generally follow in granting promotions and tenure is complex and well established. Although university administrators and committees of peers gauge performance in research, teaching, and service, few top-tier universities grant tenure to faculty with less than excellent records in research. The system for evaluating research performance is multilayered and reaches beyond the university, to encompass external reviewers, grant-providing agencies, publishers, and professional societies and associations. Scholarly and scientific journals and presses invoke their own peer review process prior to publication. The process is again applied afterward, by way of reviews, letters to the editor, citations, and any other means that help determine the impact published work has had on the profession. In tenure and promotion decisions, administrators and committees of peers usually request evaluation letters from external referees. (Faculty publication records also play a role when teams of external reviewers accredituniversities.) A recent critical analysis of this complex set of procedures finds that "there is a need for a more nuanced academic reward system that is less dependent on citation metrics, slavish adherence to marquee journals and university presses, and the growing tendency of institutions to outsource assessment of scholarship to such proxies" (Harley 2010).

The faculty reward system is self-perpetuating and deeply entrenched, not merely because of its layered complexity or because old habits are hard to break, but because our institutions are so dependent on outside entities (peer institutions) for evaluation that they are essentially unable to change unless those entities change with them. More to the point, the study just cited finds that institutions specifically discourage engaging in exactly the sort of work that concerns us here: "The advice given to pre-tenure scholars was quite consistent across all fields [archeology, astrophysics, biology, economics, history, music, and political science]: focus on publishing in the right venues and avoid spending too much time on [...] developing websites, blogging, and other non-traditional forms of electronic dissemination (including courseware)" (Harley 2010).

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[3] Beginning autumn 2010, Stanford University's Computer Sciences Department offered CS193P, "iPhone and iPad Application Development." It also offers "Developing Apps for iOS (HD)" at Apple's online iTunes University.

Tablet apps are certainly non-traditional forms of electronic dissemination. To exploit their capacity for consilience, then, individual universities would have to unilaterally revise their academic reward policies. Potentially, an app may contain more valuable research, usefulness, sustained relevance (via version upgrades), and wider opportunities for dissemination than that offered by traditional media. Universities could lay the foundation for app development by agreeing to establish policies that encourage and reward it, and appoint evaluation committees that specialize in gauging the scholarly and scientific merit of apps. An app itself might contain large-scale collaborative features that inherently reflect peer review, and the number of free downloads or purchases achieved would only be one indicator of its impact on the profession and on the university's reputation for innovation, research, learning, and scholarship.

6.2 Interdisciplinary collaboration

A second change in mindset required is one that has been in progress for some years, even if it has not yet directly addressed the divide that exists between the computer sciences and other disciplines. The move to establish interdisciplinary programs has been afoot ever since core fields like biology and chemistry gave birth to biochemistry, and has made great strides in the last decade, as dual majors, dual degrees, and hybrid programs proliferate, and as the arrival of multi-discipline journals like*IJBHT* attest. What is required now is not so much another new interdisciplinary program as the framing of a policy that rewards computer sciences departments for advancing their direct participation in intra-institutional productivity. At the same time, universities may want to create centers charged with coordinating research efforts that involve one or more disciplines on the one hand, and computer sciences on the other. These same centers could track app project development from initial concept to market and coordinate app evaluation efforts for purposes of awarding merit, promotion, and tenure.

6.3 Intellectual capital allocation

This brings us to the final change in mindset required. An app development center need not be viewed as an oddity on campus. After all, such centers are modeled after and are natural offspring of what has become a commonplace university stronghold since 1534, when Henry VIII founded Cambridge University Press. That Press's current objective is to further, through publication and *printing*, the University's mission of "advancing knowledge, education, learning, and research worldwide" (Cambridge 2011). Save for the word *printing*, an app development center's objective need be no different. (In the United States, it was not a king but a university president who, in 1878, inaugurated the first university publishing house, the Johns Hopkins University Press, which now publishes, among much else, over seventy-five journals.) In spite of their prestige, the vast majority of university presses are not profit centers; they operate at a loss and must be subsidized by their parent universities and by endowments. This is because, except in mass quantities, manufacturing dead tree books is expensive. Apps, on the other hand, require no ink, paper, glue, binding, storage, trucks, brick-and-mortar stores, or shipping. Since faculty are already assigned personal computers and since scanners and audiovisual equipment are standard fare in most universities, the costs associated with app creation are purely intellectual.

As bastions of intellectual capital, universities are perfectly positioned to meet those costs. In addition, Apple provides tools for individual and in-house enterprise app development, free iPad software development kits (SDKs), programming guides, sample code, and an iOS Developer Program to help individuals develop, test, and distribute apps(Google does something similar with its Android operating system). The purview of university app development centers need not be restricted to faculty and research. It may also accommodate students and teaching—both, in teaching with apps and in teaching how to build them. To this end, the Apple University Program is a "free program designed for higher education institutions looking to introduce iOS development into their curriculum" (Apple 2010). The Program lets professors create teams of up to two hundred students and provides development resources, app testing on iPads, and tools for presentation and grading.

7. Conclusion

As these changes in mindset begin to take hold, universities may want to ask their patent and intellectual property offices, as well as their planning, budget, and analysis staff, to develop a sustainable business model for a campus-wide app development initiative. This would include arriving at fair patent and copyright revenue-sharing arrangements (for both app- and advertising-generated revenue), formulating policies that adequately update the academic reward system, and determining who might be assigned to spearhead the effort.

As clearing houses of intellectual content and technical know-how, app development centers are bound to increase intra-institutional productivity, foment interdisciplinarity, promote synergism and collaboration among developers (porting the content, features, or code from one app to another is sometimes advisable), raise the university's research and teaching profile, and, more importantly, revolutionize the way in which new specialized knowledge, learning, and research is shared worldwide. Unlike most university presses, a university app development center might also help raise the institution's bottom line.

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