Scenario

Dr. Ghosin is facing a new teaching challenge this quarter with his introductory astronomy course. It's an extension class that will be taught on an auxiliary campus, meaning he won't be teaching in the planetarium but in a regular classroom. Each student will have an iPad on loan, however, loaded with an application called Star Walk, which identifies the stars and constellations in the area of the sky where the iPad is pointed. Before the first class, Dr. Ghosin and a member of the IT staff load the iPads with Star Walk and several other apps, including one that includes history and stories about the mythology surrounding constellations.

During class, students use their iPads to see stars, planets, and other astronomical bodies that are not visible in the daytime sky. They can drill down to learn more about individual stars or constellations, and the iPad apps let students "move the sky" to see constellations in other seasons and from any place on the Earth. Connecting what they see with the history of human attempts to both understand the movement of stars and imbue that knowledge with meaning adds another layer of interest and engagement with the content. One of Dr. Ghosin's lessons, for example, focuses on the cultural environment that allowed Western science for so long to believe that the universe revolved around the Earth.

In evening labs, which take place once per week, students can translate what they saw in the classroom to the night sky. Pairing the iPad apps with telescopic observations of stars and planets brings to life the elements of the universe in a way that even the planetarium did not, and Dr. Ghosin comes to see the iPad not simply as a viable surrogate for the planetarium but an effective replacement, providing features and opportunities for learning not available in the traditional astronomy course setting. Moreover, because students can take the iPads wherever they go, they can explore the sky through the various apps at any time and from any place.

1 What is it?

Physically and functionally, Apple's iPad tablet falls between the smartphone and the laptop. **Applications designed for this hybrid niche typically offer visual content that is more interactive than on a cell phone screen, while allowing navigation with taps, finger swipes, and pinch zooms not feasible on a typical laptop or desktop.** Many iPad applications focus on presenting content such as music, movies, magazines, newspapers, websites, games, or e-books. Apps allow the device to be used as an e-reader but with more interactive features than other e-texts, redefining what a textbook can be and do. iPads can also serve as part of a student response system and for numerous other purposes. iPads have longer battery life than most laptops, and educational applications designed for the iPad often incorporate audio, video, animation, and illustrations. iPad apps frequently make use of the touchscreen for navigation and exploration.

2 How does it work?

The iPad is well-suited for the consumption of information, with a crisp visual display and built-in wireless connectivity that facilitates easy download of the hundreds of thousands of applications available from the iTunes store. But **many applications offer more than just consumption, providing interaction and exploration as they take advantage of the touchscreen interface, web access, and large-tablet display size**. One excellent example is The Elements: A Visual Exploration, an application that hints at what e-books might one day become. The "home page" of the app shows the periodic table. Tapping on any element in the table will trigger a 3D image of an item made of that element. A touch will rotate or spin the image. Those with a network connection can tap any item in the accompanying column of facts and figures to see graphics, charts, and real-time data drawn from the Wolfram Alpha Computational Knowledge Engine website. Users can also tap to access the written text from the book itself, which offers description, facts, and stories about the element currently under investigation.

A wide range of applications support teaching and learning, including many apps developed by institutions and third-party developers. For individual study, students might find that flashcard apps like Cram offer a rich, interactive learning opportunity. Alternatively, they might turn the iPad into a graphing calculator by downloading the Pi83 application or challenge themselves with vocabulary word games like Word Warp. In a classroom setting, polling applications such as eClicker can collect, collate, and present student responses during lectures or discussions. Or the iPad might function as a backchannel tool using cloud services like Twitter or Google Moderator.

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3 Who's doing it?

A number of colleges and universities have begun experimenting with the iPad in studies that vary from campus-wide distributions to small-scale, single-class pilots. Seton Hill University, located in Pennsylvania, provided every incoming freshman with an iPad in the fall 2010 semester. Application use varied with the courses taken, but in the Modern Art and Italian Renaissance Art courses, students used Art Authority, an application that allowed them to browse through galleries containing 40,000 sculptures and paintings, searching by artist's name or the artistic period. Reed College, which tested Kindles in the classroom in fall 2009, has been testing the iPad this year in a parallel experiment. iPads were loaded with class readings to see whether or not students would prefer them to paper-based textbooks. At Scottsdale Community College, students in a journalism class have been using iPads for research and to record personal interviews. Because the iPads connect through Citrix to the campus network, students can also access non-iPad applications like Word and Publisher to write and format their articles.

4 Why is it significant?

As a single device that is smaller than a laptop, **the iPad combines robust computational functionality with a screen large enough to serve as a legitimate replacement for printed textbooks and other course materials, with the added benefits of interactivity**. The iPad also provides assistive tools, including an audio reader for those with visual impairments and support for closed-captioned content to accommodate those with hearing difficulties. Some iPad applications suggest a future where we can design our own media. Flipboard, for example, aggregates feeds from social networking sites like Facebook and Twitter and displays them in an attractive magazine-style layout complete with virtual page-turning.

In recent years, technological innovation has focused on providing smartphones with computing ability. At the same time, the debut of Apple's Mac App Store—which distributes applications designed for Apple desktop and laptop computers—indicates that the features and tools developed for mobile devices have value for a wider range of hardware. The success of the iPad has been instrumental in triggering a migration of mobile-style applications toward laptop and desktop computers.

5 What are the downsides?

All iPad apps must be approved by Apple and distributed through the iTunes store, a requirement that some say limits the number and range of available apps. Also, while the applications themselves are inexpensive, the hardware is not. Moreover, a classroom full of students running applications on their iPads can put a considerable strain on wireless infrastructure. Current versions of the iPad lack a camera, which means an application like Skype cannot offer two-way videoconferencing. Instructors seeking iPad apps for classroom use should be aware that the VGA adapter for an iPad does not automatically send a mirror image of the iPad screen to the classroom projector (as would be the case with a MacBook). Instead, this function must be explicitly provided in the software. As a result, while Keynote, YouTube, and many other applications will project with no difficulty, not all applications will.

6 Where is it going?

E-book applications for the iPad that employ the device's potential for interactivity could substantively change the textbook experience. More applications like The Elements can be expected in the near future, with tap-and-swipe access to dynamic diagrams, animated illustrations, illustrative videos, and updatable content, all available at a touch for interaction, examination, and in-depth investigation. Using an iPad as an e-reader allows searching, bookmarking, tagging, and sharing of content, which could turn a textbook from a static resource into a learning hub. Many existing applications designed for learning will become customizable: for instance, a vocabulary-building game like Word Warp could be made more useful as a learning tool if an instructor could load specific vocabulary assignments. As the iPad itself evolves, applications will emerge to take advantage of likely future hardware updates such as a built-in camera and improved hardware connectivity options. Finally, **where the iPad applications have led, other tablets and their attendant applications can be expected to follow, creating a more competitive and diverse market for tools of this type**.

7 What are the implications for teaching and learning?

The iPad was not designed to replace a user's primary computer, so the applications that run on it often turn it into an appliance: a netbook, an e-reader, a calculator, or a student response device. Some applications, like History: Maps of the World, exploit the iPad's capabilities to support multiple learning styles, inviting users to match music and artwork on the touchscreen with the appropriate time and geographic location, thus presenting data that is visual, auditory, and kinesthetic. At the same time, the iPad's tactile interface and media-friendly approach introduce an element of fun into the learning experience. The planetarium app Star Walk, for example, allows users to navigate the night skies, tapping for information on stars and their satellites, swiping for images of constellations, and examining changes in the heavenly bodies through time-lapse animation. At their best, these **applications that live in the spaces where education and entertainment overlap can capture the imagination, enticing students to learn on their own**.

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