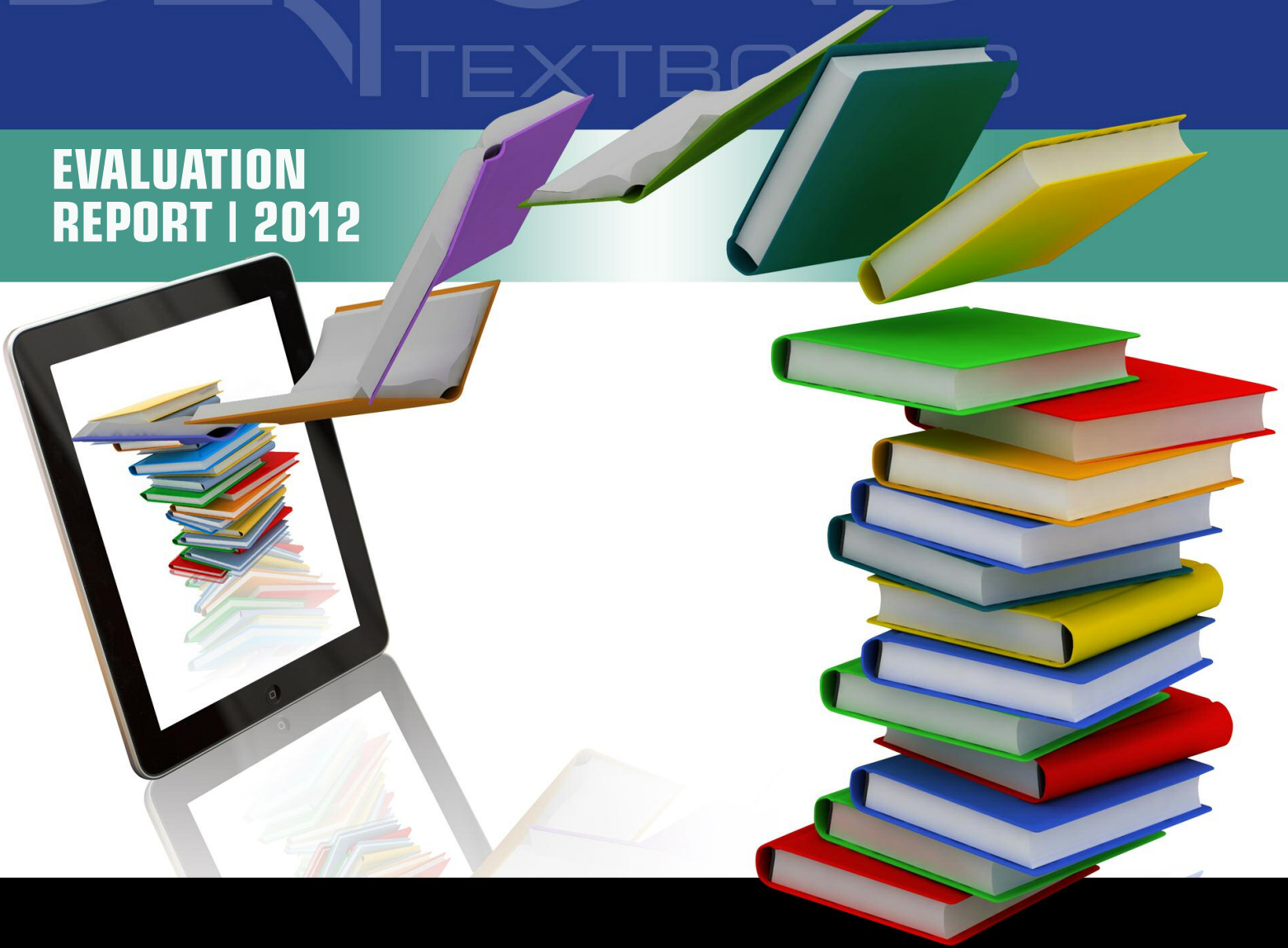


# Beyond Textbooks

Beyond Textbooks:  
Digital Textbooks in an  
Online Course

EVALUATION  
REPORT | 2012





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## Beyond Textbooks: Digital Textbooks in an Online Course

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# INTRODUCTION

## Purpose

The Virginia Department of Education has implemented several pilot projects that explore the classroom implementation of digital textbooks on multipurpose portable devices, such as Apple iPads. This *Beyond Textbooks* project and related pilot projects are part of *Learning without Boundaries*, a broader initiative that incorporates wireless mobile handheld technology into teaching and learning.

One of these, begun during the 2010-11 school year and repeated during the subsequent year with a different student population, explored how digital textbooks can support online courses. The online learning pilot was implemented as part of an Advanced Placement (AP) Biology course, offered by Virtual Virginia, the state's online learning program. A digital version of the McGraw-Hill Raven *Biology* textbook (e-book) was developed by Inkling, a California-based software engineering company. Each year of the pilot, a group of students enrolled in the AP Biology class accessed the e-book on an Apple iPad. Additional cohorts of students participated in the online class using the print-based version of the textbook.

This report presents outcomes from these pilot studies with considerations for further research on and development of digital text. Overall, the students and teachers received the iPad and e-book positively, and a significantly larger percentage of students in the treatment group successfully completed the course. This suggests that more research is needed into the use of digital textbooks to support online learning.

## Goals

The *Beyond Textbooks* pilot projects are treading new ground. As the developers at Inkling note, new affordances of mobile handheld technologies provide opportunities not just to re-create the textbook but to "reinvent it." These projects are helping to determine the potential for how this new media can support teaching and learning in ways that traditional resources cannot. Questions related to this paradigm shift are *not* best answered by, "Is this better than . . . or not?" Instead, this pilot project attempted to help determine the potential of these new technologies and how they can support student learning.

This pilot project intended to provide information to help answer the following questions:

- How do students and teachers use e-books to support learning in an online course? What suggestions or recommendations do they make?
- What impact, if any, can be determined regarding measurements of student achievement? What types of measurements might be necessary in further initiatives?

# OVERVIEW OF THE PROGRAM

## Program Description

The Virginia Department of Education has provided various forms of distance-learning opportunities for students in the Commonwealth for more than two decades—beginning with satellite delivery of instruction in the 1980s and continuing with Web-based delivery in the past decade. The Department has combined these programs into an online learning program known as Virtual Virginia.

While students have 24/7 access to all course materials and content, courses provided by Virtual Virginia are taught by certified teachers with successful experience. So, while students have some autonomy as to when and where they access materials and complete activities, Virtual Virginia uses a cohort-based model that keeps students on a weekly schedule based on the start date of their cohorts.

The courses provide information and activities through a variety of media and technology, but it is not uncommon for some classes to use print-based textbooks, especially since textbooks are reviewed for statewide adoption and since many are already aligned to Virginia's Standards of Learning (SOL). Therefore, students traditionally enrolled in the AP Biology course, whether through Virtual Virginia or in a class at their home school, would likely use the McGraw-Hill Raven *Biology* textbook. In addition to the content in the traditional textbook, the digital version included a *social notes* function, which allowed students to interact with the course instructor.

AP Biology is intended to be the equivalent of a first-year introductory college biology course. Students must have first successfully completed foundation courses in biology, chemistry, algebra, and geometry, whether at their home school or through an online program. And much like traditional class settings, students in the online course participate in a variety of hands-on—and some virtual—labs that meet the College Board's laboratory objectives.

Much like AP Biology classes offered in the state's high schools, students can enroll in the class for a full year or for a semester—the semester course is operated similarly to block schedules found in many high schools.

The ways students study and learn from a book are often different than simply reading a book for other purposes. Students may incorporate different kinds of strategies, such as reading more slowly or carefully, previewing chapter headings and other organizers, identifying or perhaps looking up keywords (often presented in boldface), or reviewing questions presented in the book or by others. With some print materials, students may also highlight, underline, or make notes in the margins; while these types of physical changes are usually not allowed in a school-owned textbook, there are no limitations for making these types of notes in digital texts, if the software supports this function. In addition, the *social notes* function of digital text often allows students and teachers to collaborate around these learning strategies.

Students accessing the e-book on the iPad were given access to the *Biology* (9<sup>th</sup> Ed.) textbook by Raven, Johnson, Mason, Losos, & Singer (published by McGraw-Hill). The iPad allowed the students to use “gesture-based” technology—swiping the text to scroll, increase/decrease text and images, and follow hyperlinks through the touchscreen interface. The Inkling e-book also contains quizzes at the end of each chapter and note-taking features.

### **Participants: Year 1**

Students enrolled in the full-year AP Biology cohort were eligible to participate in the pilot program in Year 1. The 14 students (2 male, 12 female) who opted to participate were provided with iPads that included the e-book. An additional 26 students (7 male, 19 female) used traditional course materials, including a print-based version of the textbook and accompanying online resources. These are the same resources available for face-to-face AP biology courses.

For comparison purposes, outcomes from an additional 19 students (6 male, 13 female) enrolled in semester-long cohorts (either fall or spring cohorts) during the 2010-11 school year were used to analyze student achievement, bringing the total number of students in the pilot to 59. These comparison students used traditional course materials and had the same teacher for the course.

Data from the full-year iPad cohort (FY-IP, n=14) were compared with the remainder of the full-year cohort that did not receive iPads (FY, n=26) and a combined group of all students in the 2010-11 school year enrolled in any Virtual Virginia AP Biology cohort who did not receive an iPad (ALL, n=45); 26 of the 45 students in the ALL cohort are represented by the FY cohort.

The FY-IP cohort was approximately 86% female and 14% male, while the FY and ALL cohorts were approximately 73% and 71% female, respectively. These differences in gender composition of the different cohorts apparently had no impact on measurements of student performance.

### **Participants: Year 2**

As in Year 1, only students enrolled in the full-year AP Biology class were eligible to participate in the treatment group and receive access to an iPad. A total of 26 students originally agreed to participate—of these, 17 completed the course. One student was given an extension due to illness, so data for this student were not included in this review, and the remaining eight students dropped the course. Students in both the treatment and comparison groups dropped the course for various reasons, such as difficulties with their course loads, the desire to enroll in different courses, lack of participation, and personal reasons. No students in the treatment group reported the eBook as their reason for dropping the course. Of the 17 students in the treatment group who completed the course (FY-IP2, n=17), 7 were male, and 10 were female.

The students comprising the comparison group were only those enrolled in the full-year cohort. Students enrolled in semester-long versions of the course were not used for comparison in Year 2. The spring block was cancelled, so no students participated. In addition, changes made by the teacher to the format of the final exam in the fall block resulted in significantly higher scores on this assessment, skewing two of the three data used for comparison. An additional 51 students who did not receive access to an iPad enrolled in the full-year course. Of these, 14 completed the course (FY2, n=14), including 4 male and 10 female students, and served as the comparison group.



# DESIGN

## Data Sources

Qualitative data about the teachers' and students' use of the digital textbook were collected through surveys and interviews. These data focused on use of the digital textbook, any perceived benefits or limitations, and attitudinal data related to how the materials were used. Students enrolled in any course offered through Virtual Virginia are required to complete midterm and end-of-year surveys. In addition, participants in the treatment cohorts in both years completed an additional survey about the digital textbook. See the appendix for a list of student survey questions. Interviews with students in the FY-IP cohort and the teacher were conducted online using Web-conferencing software with prepared questions.

Using methods common for analyzing qualitative data, the data were reviewed for patterns and themes. This process identified potential themes that may have been known prior to the start of the analysis and some follow-up questioning to identify additional themes (Creswell, 2010).

Several quantitative measurements of student performance were collected, when available. All students received a final exam grade and a final course grade from the instructors. In addition, biology scores on the SOL assessment—administered at the students' base schools—were reported for most students ( $n=50$ ) in Year 1. After review, it was determined that the SOL assessment scores correlated weakly to standards covered during the course, and so they were not used in Year 2. Scores for those students who took the AP exam administered by the College Board were also reviewed for both years ( $n=53$  in Year 1;  $n=27$  in Year 2).

One limitation of the pilot project was that the students self-selected to participate in the treatment group; therefore, assignment to the groups was not random. Also, the small sample size and nature of the data prevented some statistical tests from being used to compare student performance measurements; so, while themes from the data and descriptive statistics are presented here, it is not reasonable to attribute causality to any of the outcomes, and generalizations should be used in light of these limitations.

## Data Analysis

### Survey and Interview Data Year 1

During interviews in Year 1, a large majority of the students reported a preference for the digital textbook. They appreciated some of its interactive aspects versus typical print-based textbooks, and several noted that it was more engaging and, as such, used it more often than they would have a print-based book. In the follow-up survey, nine students (69.2% of those who responded) said they would spend less time with the traditional text if the e-book was available, compared to two students (15.3%) who preferred the traditional text.

Students mentioned the following as being especially helpful features: the quizzes at the end of the textbook, the *social notes* components, and the ability to enlarge text and images easily and to view 3-D models and images. The quizzes provided immediate feedback and were a means for self-evaluating understanding. In the follow-up survey, a majority of the students ranked all of the components in the following list as easy or very easy:

- Adjust the text size
- Adjust the brightness
- View download information
- Request to follow someone on shared notes
- Approve a request to follow your notes
- Edit your Inkling profile
- Change your Inkling password

Although, four students did not use the *shared notes* feature, and six did not try to edit their profiles or passwords.

Additional activities designed specifically for the digital format were requested. Some students noted that searching the text was very easy and helped them complete their assignments more efficiently but that the glossary and index were not searchable. Also, the students and the teacher often mentioned the lighter size and weight of the e-book compared to the print-based textbook as a benefit.

When asked to rank locations where they had used the iPad and e-book the most, students in Year 1 most often mentioned home (58.3% of those responding). Public transportation (25%) and class (16.7%) were mentioned less frequently.

Students noted some issues with the iPad itself, perhaps indicating some unfamiliarity with the device. The teacher noted that the original installation of the digital textbook frustrated some students. Students had to create accounts in iTunes with their Virtual Virginia usernames rather than with their personal accounts. One student noted that the iPad would “dim” when he or she was not interacting regularly with it. (This feature, called “auto-lock,” can be changed in the device’s settings, even to the point of never going into auto-lock mode.) Two students noted a preference for the print-based textbook—one because he or she was more familiar with traditional learning strategies based on prior experience. The lack of a keyboard and fingerprints on the screen were also noted as issues with the device. Students also mentioned security concerns about bringing their iPads to school—on the other hand, they were not concerned about having a traditional textbook stolen.

At the end of the course, 83.3% of the students surveyed strongly agreed that they had learned how to use the digital textbook features by “exploring the application by myself”; students did not report using any other methods to learn using the features. When asked to rate three additional learning strategies, students overwhelmingly disagreed or strongly disagreed that they had (1) talked to classmates about the application, (2) watched the instructor use the application, or (3) visited [www.inkling.com](http://www.inkling.com) to learn the features better.



Students mentioned that the *shared notes* feature supported collaboration or interactions with the teacher—more so than with traditional classes. The teacher corroborated this finding, admitting that the advantage from an instructional standpoint was “a real surprise.” This support for feedback was seen as beneficial, but several students reported that they had not been able to access the Internet on their devices at school. They did, however, access the Internet elsewhere and reported wanting to have more content developed specifically for the iPad.

## Survey Data Year 2

In November and early December, 14 students from the treatment group who received the mobile devices responded to the online Initial Student Survey about their technology use and early impressions of the e-book; 11 students from the treatment group also responded to a follow-up survey in late April; a 12th student, who did not complete the survey, reported not using the device during the course because it was not allowed on his or her school network. All of the students who responded to the initial survey reported previous experience using computers, and several mentioned experience with additional technologies, such as cellphones and smartphones, iPods, Kindles, as well as iPads. All also mentioned that they use technology often to support their schoolwork at home, usually every day. As one student said, “I constantly use technology.”

When specifically queried in the initial survey, all students reported using either an iPad in conjunction with their home desktop or laptop computer or just a computer by itself. No student reported using only an iPad to support their AP Biology work. Despite this, the students’ impressions of the iPad were overwhelmingly positive. Many described the devices as being “fun” and “easy to use.” Overall, the students also were positive about the e-books—ranging from a very enthusiastic “WOW! What a resource! It has everything I could ask for in a textbook,” to mild optimism, “Interesting, could be useful.”

When asked in the initial survey to describe how they complete their AP Biology work, most students reported using an iPad with e-book as they would a more traditional print-based book. Reading was the most often reported activity associated with the iPad—both for initial reading and as a resource to look up information during assignments. Most students reported using a home or school computer to complete writing assignments and to navigate the course Web site; although, one student did mention using the iPad to access the course Web site. In the initial survey, one student noted preferring to use a different print-based textbook than the assigned print-based textbook and corresponding e-book because of the perception it was “easier to understand and more fun to read.” In the follow-up survey, there were few differences regarding use; students often mentioned that because iPads are easy to transport, they could access the course content more often from different places, even on a bus or at a local coffee shop. Unlike the students in Year 1, the students in Year 2 reported using the device and e-book app in class more than any other location; although, the margin was close, with only one more student reporting class use as compared to home use (class = 45.5%; home = 36.4%).

In both surveys, the most often reported benefit was the ability to search for information in the e-book. Several students noted how difficult it could be to search a large (almost 1,300-page) printed

textbook, but many noted that the e-book was easy to navigate and search through; some perceived that it saved time. Since students were still becoming familiar with the device and the e-book app at the time of the initial survey, there was limited mention of additional features that might support their understanding of complex situations. One student noted that being able to highlight, take notes, and then share notes with others was helpful. Other reported benefits included the ability to enlarge digital images, the interactive digital models, the ability to take notes in the text, and quizzes within the app, but these were not reported by multiple students in the initial survey. In the follow-up survey, additional students mentioned the value of taking notes in the text and of the digital images. One student noted in the initial survey that it was harder to read the digital text and preferred the printed text; this student later noted this preference for paper textbooks was “because I’m used to them.”

In the follow-up survey, students were asked to rate the difficulty of different features. Most students rated adjusting the text size and the brightness of the device as easy or very easy. The e-book supports the sharing of notes, but of the students who tried this feature, most thought it was difficult to request to follow someone on shared notes and to approve a request to be followed. However, it should be noted that only six of eleven students who answered the question (54.5%) reported trying these features.

Students also noted some challenges to using the text. One student would have preferred to look at more than one part of the text at the same time to compare information. Another noted that with a digital text, it is difficult to gauge how much information is available in a section. A few students mentioned limited access to the Internet as a challenge; although, this did not appear to be a significant barrier since it could often be overcome by going to local businesses or other locations with Internet access. Personal factors were also mentioned, such as the temptation to go off task and use other apps or games on the device, but these challenges are not inherent to the e-book.

Similar to Year 1, students in the follow-up survey agreed or strongly agreed that exploration was the only method they used to learn features in the Inkling e-book. Most students disagreed or strongly disagreed that they learned features by talking to other classmates, watching the instructor, or visiting [www.inkling.com](http://www.inkling.com).

In the initial survey, as might be expected for students enrolled in a high-level class, most reported a high interest in science and did not think the device or the e-book app would change that perception. This was confirmed in the follow-up survey, when only one student mentioned an increased interest in biology due to access to the device. This student confirmed that having ready access to the content on the portable device was helpful and that it “made the class more fun and more intriguing.”

Students in the follow-up survey did not report using the e-book much differently than they would a printed text. Several reported that they probably read the e-book more often because they had access to it at all times. When asked for their preference between print and digital textbooks, students in Year 2 were more varied in their responses compared to the previous cohort: four (36.3%) reported that they would spend less time with the traditional print text if given the choice, three (27.3%) reported that they would spend more time with the traditional text, and two (16.7%) reported that they would still likely spend the same amount of time with the traditional text.

In both surveys, portability was often mentioned as a benefit. In the follow-up survey, several students noted that their use of the eBook was not much different but that the entire online learning setting was novel to them. Only two reported previous experience with e-books or online textbooks. Because it was a unique setting for most students, several reported that it required much more self-directed learning, which students reacted to both positively and negatively, but it did not appear to impact their use of the device. One student noted, “We didn’t have a lot of assignments that involved the iPad, so there wasn’t much difference. I wish we had more interact[ion]s with the iPad.”

### Student performance data

Mean scores on the final exam, final course grade, Biology SOL score (if known), and AP exam score (by those who took it) were computed for three groups (see Figures 1a and 1b).

	Final Exam	Final Course	Biology SOL Score
FY-IP	82.50	86.50	514.67
FY	80.58	83.54	511.55
All	79.33	83.87	509.32

Figure 1a. Mean group scores for year 1

	Final Exam	Final Course	Biology SOL Score
FY-IP2	82.12	84.00	NA
FY2	81.86	87.00	NA

Figure 1b. Mean group scores for year 2

For three measures in Year 1, the mean scores for the iPad group were higher than the other groups, when compared to the mean of the full-year cohort and the mean of all other cohorts combined. These differences, while encouraging, are not statistically significant.

In Year 2, the students in the treatment group (FY-IP2) had a higher mean score on the final exam, but students in the comparison group (FY2) had a higher mean score on the final course grade. The differences between the two groups on the final exam scores and final course grades were not statistically significant. SOL scores were not used for comparison of these students, as mentioned earlier.

For all groups in both years, the modal score, or most common score, on the AP exam was 1—meaning that more students scored a 1 than any other score—however, for most students, the goal is a score of 4 or 5. To receive college credit for the AP Biology course, one requirement for most colleges is that students score at least 4 or 5. This is a significant goal, as it represents a time-and-cost savings for students while making them stronger candidates for admission. For each cohort, the percentage of students scoring 1-3 was compared to the percentage of those scoring 4-5.

In Year 1, the total percentage of every student who took the AP Exam and scored between 1 and 3 was 77.36 percent, while 22.64 percent scored a 4 or 5. These are similar to the percentages by

cohort (see Figure 2a). In year 2, a slightly larger percentage of students from the treatment group scored a 4 or 5 on the AP exam (FY-IP2 = 28.54%) as compared to the comparison group (FY2 = 25%) (see figure 2b). Additional research would be needed to isolate the causes behind these conflicting results on the AP exam.

	FY-IP	FY	ALL
3 or less	77.00%	75.00%	77.50%
4 or 5	23.00%	25.00%	22.50%

Figure 2a. Percentages of students scoring 3 or less or 4 or 5 in Year 1.

	FY-IP2	FY2
3 or less	71.43%	75.00%
4 or 5	28.57%	25.00%

Figure 2b. Percentages of students scoring 3 or less or 4 or 5 in Year 2.

## FINDINGS

**Ease of use.** Students overwhelmingly reported that the device and e-book were easy to use; although, they most frequently reported using them in a similar fashion to more traditional print-based books—primarily initial reading for assignments and follow-up use as a reference tool when completing activities. The device itself and the digital media appeared to engage to students and may have influenced their preference. The lightweight, portable device encouraged several students to note that they were more likely to access the content in the e-book as compared to a printed text. A larger percentage of students in Year 1, compared with Year 2, preferred the device over a printed text. It would be interesting to observe if these preferences would change in a course where some of the additional functionality of the e-book is incorporated more consistently into practice—this potentially could produce a different learning experience.

Students in both years agreed that they found the device’s basic operations to be easy, with less agreement on some of the e-book’s functionality. All the students in Year 2 reported extensive, often daily, prior use of various technologies, such as laptop and desktop computers, cell phones and smartphones, as well as some iPods and iPads. In terms of unique features of the e-book, the students most frequently mentioned the ease of searching it. The students could search the vast quantity of content through keyword searches, with which they likely were familiar from routine Internet research and other applications. Searching the printed text was noted as being cumbersome. Students in Year 1 noted that the quizzes were helpful self-monitoring tools, but the students in Year 2 did not mention using this feature. Students in Year 2 also disagreed with the previous cohort that the *shared notes* feature was easy to use; although, not all students had tried it.

Some students, especially in Year 1, reported having difficulties with the device. Some of these issues, such as having to create an iTunes account for the device, were not mentioned by the students in Year 2. Other issues represented a lack of understanding of some of the device's features. A couple students in both years noted a preference for the printed textbook based on familiarity. As these and similar devices become more familiar to teachers and students and as support issues become better understood, it is likely these issues will be less of an issue—this trend possibly was reflected in the Year 2 students, who noted fewer issues than those from the previous cohort.

**Learning to use the device.** Students overwhelmingly reported that they learned to use the device and e-book through exploration and trial-and-error. Neither the teachers nor the students mentioned a formal orientation or training. Because the students were located at different places throughout the state—a characteristic of distance learning—few reported talking to classmates about how to use the device. Unless encouraged and facilitated by the instructor, many students in an online course will not participate in distant discussions outside class. Students in an online course often have different schedules and may not feel as comfortable communicating with others who they know only through limited, often text-based, academic contact—as opposed to those with whom they interact on a daily basis. Student motivation to take an online course is also often intrinsic, and many online students focus on completion goals rather than socializing.

**Types of use.** As its mission, InKling notes that it is trying to reinvent the textbook, but there is little indication that the AP Biology class has been restructured or reinvented to leverage all of the available functionality. Students access the content in ways similar to printed textbooks with little use of evolutionary functions. Students consistently reported using the e-book to read content and then again as a reference while completing activities. Very few reported using the device to access the class activities, and none reported using only the device to complete their work.

It is not apparent that the teacher adjusted the class activities to a significant degree to leverage these features. One student noted that few assignments required the device. Teachers in AP courses, however, have limited leeway as to how they can restructure course content and activities. AP courses are structured and audited by the College Board, and individual teachers have some, but little, freedom in terms of adjusting the course. As a result, this innovative resource was implemented in a program that may not have been ready for that innovation. As these devices and new forms of content become more readily available, teachers may become clearer on ways they can incorporate the new functionality and pedagogies these resources support and still meet the requirements of overseeing organizations, such as the College Board in the case of AP classes.

**Consistency of use.** It is interesting to note that the students in Year 1 mentioned the *shared notes* and quizzes in the e-book as being beneficial but that the students in Year 2 did not find the *shared notes* feature easy to use. Also, no student in Year 2 mentioned using the quizzes in the e-book in the follow-up survey. It is unclear as to why students in one cohort found the functionality useful while the students in the following cohort did not. Reasons for this could include lack of training on the device and e-book, which was noted for both groups, or little or no emphasis on these functions because of the course structure. While students in Year 1 found *shared notes* beneficial, the teacher noted that this was surprising. Student use in Year 1 may have been more experimental than intentional.

Decisions whether to incorporate these functions intentionally could be influenced by outside pressure to present course material in an approved way, as mentioned previously.

**Location of use.** Students in the two cohorts differed when reporting where they used the devices most often; although, both mentioned at home and in class. Students in Year 1 reported using the device most often at home, while students in Year 2 reported a slight preference for using the device in class. Students may not have had the same amount of time to access Virtual Virginia courses during the school day; this may account for some of the differences regarding where the devices were used. Also, some divisions did not allow students to use the devices to access the Internet at school.

**Student performance.** There was no statistical significance in any of the student performance measurements in Years 1 and 2. Students in the treatment group in Year 1 performed slightly better than their peers in the comparison group, but the opposite was true in Year 2.

The modal score, or most common score, on the AP exam for all groups was 1. However, for these two years, students enrolled in AP courses in Virtual Virginia could take AP exams at no cost. This may have increased the number of students who took the exams, including some who may not have been ready.

**Motivation for completion.** Enrollment data were more readily available in Year 2—due to the use of a new data system—and were reviewed along with performance data. Enrollment data indicated that a significantly larger percentage of students in the treatment group (FY-IP2 = 65.4%) completed the course successfully as compared to the comparison group (FY2 = 27.5%). While course completion was not an original focus of the evaluation, these numbers encouraged the evaluators to request Year 1 numbers for comparison. As with Year 2, a significantly larger percentage of students in the treatment group (FY-IP = 100%) completed the course successfully. In fact, all of the students in the treatment group completed the course. This contrasts markedly with the percentage of students in the full-year comparison group (FY = 28.2%). Students in the semester-long comparison groups completed at higher rates (Fall Block = 69.2%; Spring Block = 42.4%), but, when compared with all students in a comparison setting (ALL = 35.9%), the percentage of completers was extremely low because most students enrolled in the full-year course.

Additional information is needed to understand better why this significant difference exists; however, it does draw attention to the students' positive perceptions of the device and e-book and the fact that these students reported being more likely to review course content more often on the device than when using a printed textbook. This perception was often paired with comments about the device's lightweight portability; one student mentioned that she could take it into her favorite coffee shop to study—something she would not do with a heavy print-based textbook because it is "a hassle." The freedom to support flexible learning is a common motivation for enrolling in online learning, and the device and e-book may have increased the students' motivation to complete their work simply because it is easier to carry around and is available more often. While this may not have resulted in any apparent differences in student achievement, it is possible that a larger percentage of students were able to complete the course at achievement levels commensurate with their peers. Another factor that could have influenced the significantly higher completion rates for the treatment group is that



highly motivated students may have been more likely to volunteer for the treatment group. The option to participate in the treatment group was offered to all students in the full-year cohorts; however, further studies may be needed to determine the motivational aspects of the device.

Online course providers often struggle with course completion rates, especially when students take courses above and beyond their normal course loads and can drop difficult or time-consuming courses with little or no penalty. Many students perceive that an online course will be less rigorous or time consuming than face-to-face courses, but this is not always the case, especially in a course governed and audited by an external agency. These classes must cover the same content as their face-to-face versions. Students in both groups gave the same answers as to why they dropped the course. While there was no significant difference between the two groups in terms of student performance, additional studies are needed to determine whether students might be more motivated to complete a course when provided ubiquitous access to the course content on lightweight, portable devices.

## CONCLUSION

Few students reported using the e-book differently than a more traditional print-based text. The most commonly mentioned uses were in reading content and then using the e-book as a reference while completing assignments on a laptop or desktop computer. This may be due more to the way the course was structured, however, than the affordance of the technologies. This particular course is externally audited by the College Board, so it may have been less possible to incorporate the technology's innovative functions. Students overwhelmingly reported that the device was easy to use, and a majority reported a preference for it over the printed text.

Some of the simpler features and components of the device and e-book could have influenced the participants' preference for the digital textbook over the static printed book. Some of these features, such as the ability to enlarge text and images and to search the document quickly, are inherent in many digital technologies and easy to incorporate into digital curricular resources. Additional features, such as highlighting and note taking, were mentioned occasionally and are extensions of common strategies used with printed materials. It may be possible to integrate other applications that build upon other common learning activities, but these may require additional pedagogical support, training, or modeling because some of the existing additional functionality in the device and e-book was rarely used. For example, one extension of these features could automatically generate student notes or outlines based on highlighted text. Depending on the types of instructional activities that use the devices, some consideration should be given to including external keyboards for some students, what those activities might be, and how those students can be identified.

It may also be necessary to instruct students about some of the common features inherent to the device and e-book, especially since one student reported struggles with features that could be changed and since a few students noted that they preferred the print-based textbook simply because they did not

want to learn new strategies or were more familiar with the printed book. Also, since almost all of the students indicated that they learned the features of the e-book on their own, some explicit instruction, whether facilitated synchronously by the instructor or presented asynchronously through animation- or video-based tutorials, might help students use the digital textbook more efficiently and effectively. Students in Year 1 noted that the *shared notes* and quizzes were helpful, but the Year 2 students did not mention these functions. Modeling and incorporating these features into instruction should increase the likelihood of their use.

From a management standpoint, educators at schools considering shifting to a digital curricular device may need upfront professional development, information sharing, strategies, or even management tools to leverage these new tools and content resources more effectively. Some important issues to consider are getting the devices up and running with all relevant resources and keeping those resources up-to-date when updates or revisions are necessary. Because these students attended different schools, not all of their devices were supported on their school networks, limiting when and where they could access the content. Division network managers may need to be informed or provided guidance as to how students enrolled in state-sanctioned educational programs, such as Virtual Virginia, should be given full access to division infrastructure resources. Students in Year 1 also expressed concerns for keeping the devices secure throughout the school year. Those implementing programs that rely on small, portable digital devices may want to investigate both physical and software solutions for tracking and monitoring them.

An additional strength of digital textbooks, compared to static printed textbooks, is the opportunity to provide individualized feedback so students can monitor their own learning—whether through practice quizzes that support forced-choice responses or the social interaction provided through feedback by the teacher or other students. The fact that students requested additional activities to assess their learning bodes well, indicating that the digital platform could promote greater student use of effective learning strategies, such as self-assessment and monitoring strategies, especially in an online setting where self-directed learning skills can be a requirement for success. The desire for additional content formatted for the device may indicate that the students felt comfortable using the features of the digital textbook and that a device like this could support a learning system of resources and tools.

Of particular interest for additional study is the potential role of these types of devices in motivating students to complete a course. Completion rates are a perennial concern for online programs, especially since many students in an online course have much greater leeway as to whether they complete a course or not, as opposed to a course in a physical classroom. The significantly higher completion rate of students in the treatment group as opposed to the comparison groups—in both years—raises the question as to whether the device itself can increase course completion rates by motivating students to access the content more often. Further studies should examine whether some of these trends can be repeated in other contexts—namely that the students reported having better access to and being more motivated to access the content.

The lack of significant difference in student performance outcomes in both years suggests what many educational technology advocates promote: that technology alone is insufficient to produce change. It

is not the device but how it is used that can make a difference. And, in this setting, the device was used to replicate common and existing practices rather than promoting new practices that might impact student achievement. These can involve teaching and learning practices but may require several factors not evidenced in this pilot, including the ability to change pedagogy; readiness at the program level to support innovation; training for teachers and students on leveraging new devices and content; and infrastructure support for new learning devices that enables students to learn anytime, anywhere. As devices like those in the pilot increasingly are used to deliver digital content in schools, these additional factors should be considered to improve how these technologies are used—with the goal of helping more students reach their academic potential.

# APPENDIX

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## Initial Student Survey

1. What technology have you used prior to this program?
2. How often do you use this technology to complete your work at home?
3. What technologies, if any, do you use at home to complete your work for AP Biology?
4. What is your impression of the iPad?
5. What is your initial impression of the app?
6. Please describe how you currently complete your AP Biology work.
7. How would you describe and imagine the ways in which using the eBook modules will aid or hinder your understanding of events or concepts?
8. What about these modules do you believe will be helpful to your learning?
9. What do you think you will find to be challenging?
10. How, if at all, would you describe the ways in which using the e-book modules will aid your understanding of complex situations?
11. How, if at all, do you think your perception of and interest in science will change after using the e-book modules in your class?
12. How would you describe and imagine using the e-book modules will be different than what you typically do in a science class?
13. How would you describe and imagine using the e-book modules will be different than what you typically do at home or outside of school? What about these differences do you like? Dislike?

## Follow-Up Student Survey

1. Please describe how the iPad helped your understanding of the course material.
2. Please describe how your perception of and interest in AP Biology changed after using the iPad in your class.
3. Please describe how using the iPad is different than what you typically do in a science class. What about these differences do you like? Dislike?
4. Please describe how using the iPad is different than what you typically do at home or outside of school. What about these differences do you like? Dislike?
5. Have you used any e-textbooks or online textbooks before this pilot program? (Yes/No)
6. If yes, which of the following platforms have you used?
  - a. CourseSmart
  - b. VitalSource
  - c. McGraw-Hill Connect
  - d. CengageBrain
  - e. Pearson MyLabs
  - f. Other, please specify
7. How difficult or easy is it for you to do the following?
  - a. Adjust the text size
  - b. Adjust the brightness
  - c. View download information
  - d. Request to follow someone on *shared notes*
  - e. Approve a request to follow your notes
  - f. Edit your Inkling profile
  - g. Change your Inkling password
8. Do you prefer to use Inkling in portrait or landscape mode? (Portrait/Landscape/No Preference)
9. Think of the different places where you spend time with your Inkling textbook. Rank these places based on the amount of time spent using your Inkling textbook. Leave blank if the location does not apply. (1 = most time spent, 7 = least time spent. Values may not be repeated)
  - a. Class
  - b. Library
  - c. Home
  - d. Outdoors
  - e. Café/Restaurant/Lunchroom
  - f. Public Transportation
  - g. Other

10. Imagine for a moment that you have the traditional copy of your AP Biology textbook instead of the InKling version (iPad). When compared to InKling, do you think you'd spend less, the same, or more time with the traditional textbook?
- I'd spend less time with the traditional.
  - I'd spend the same amount of time with the traditional.
  - I'd spend more time with the traditional.
  - I don't know.
11. Do you follow your instructor on *shared notes*? (Yes/No)
12. Do you use any other tools to share notes and opinions with other students?
- Class blog
  - Class discussion
  - E-mail
  - Face-to-face via Elluminate Live!
13. Rate the following statements. (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree)
- I am doing really well in this class.
  - I feel really engaged in this class.
  - I know my instructor really well.
  - My instructor knows me really well.
  - My classmates help me in this class.
  - I talk to my instructor outside class time.
  - I am an above-average student.
  - I prefer to be by myself when reading the textbook.
  - I prefer to be by myself when studying for a test.
  - I prefer to be by myself when doing homework.
14. "I learn how to use the features in InKling by . . ." (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree)
- exploring the application by myself
  - talking to my classmates about the application
  - watching the instructor use the application
  - visiting [www.inkling.com](http://www.inkling.com)



# REFERENCES

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# ABOUT THE AUTHORS

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Dr. John Ross has been an educator for 25 years and is the author of *Online Professional Development, Design, Deliver, Succeed!* from Corwin which was adopted as book-of-the-month for July 2011 by Learning Forward (formerly the National Staff Development Council) and reached the “bestseller” category for the publisher in its first year of publication. He is also coauthor of the first college textbook to address the new National Educational Technology Standard for Teachers. He works with states, districts, schools, and individual teachers to help use technology to promote teaching, learning, and school management. You can find out more about him on his Web site [TeachLearnTech.com](http://TeachLearnTech.com).

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