Mobile devices in education

**A report on five case studies involving the use of the
Amazon Kindle ereader and the Apple iPad media tablet
for educational use**

Kosie Eloff, University of Pretoria

One organization with the aim of bringing books to schools in Africa

WORLDREADER

English | Español | Català   **DONATE**

Worldreader
Books for all

home   about   our work   authors   partners   donors   press   blog

MINISTRY OF EDUCATION
MINISTÈRE DE L'EDUCATION

Worldreader and the Ghana Ministry of Education work together to select schools for the 400-student iRead pilot.

《 》

Books Open Brains

Books and the ideas in them engage minds and create opportunity, but only for the few. Families and schools in the developing world have access to vanishingly little written material. Worldreader aims to put a library of digital books in the hands of every family.

Making Headlines

The Wall Street Journal
Nonprofit Tries One-Kindle-Per-Child In Ghana

BBC
David Amanour covers the first days of the

Worldreader

- Digital books to all in developing world
- Identify schools, train teachers, work with communities, partner with publishers
- Companies (e.g. Random House, Amazon & government institutions e.g. USAID)
- Trial in Spain
- First project in Ghana
 - ~ 450 Kindles in schools

E/READER GUIDELINES

1	POWER SWITCH ON	Slide and release power switch to wake. Movement to your right. Green Light shows up to signify power on
2	POWER SWITCH OFF	Slide and release power switch to Sleep. Movement to your right. Green Light shows up to signify power off
3	WHEN POWER SWITCH ON	Press Home Button. Search for Textbooks on visual.
4	TO TEXTBOOK	Use 5 ways controller to underline Textbooks (by the curser).
5	TO COURSE TEXT BOOKS	Enter by pressing 5 ways controller button in the centre.
6	TO SPECIFIC TEXT BOOK	Use 5 ways controller to underline the Textbook (Mastering Social Studies for Junior High School: Bin Josim and W)
7	MOVE INTO TEXTBOOK	Enter by pressing centre of 5 ways controller.
8	TO LOCATE TABLE OF CONTENT. 1st. STEP	PRESS MENU BUTTON
9	2ND. STEP	USE 5 WAYS CONTROLLER TO UDERLINE `GO TO.....`
10	3RD. STEP	ENTER BY PRESSING CENTER OF 5 WAYS CONTROLLER.
11	4TH. STEP	USE CURSER TO LOCATE TABLE OF CONTENT. PRESS CENTRE OF 5 WAYS CONTROLLER.
12	CHAPTER/TOPIC SELLECTION	USE CURSER TO SELLECT TOPIC CHAPTER. ENTER BY PRESSING CENTRE OF 5 WAYS CONTROLLER.
13	TOPIC SELECT TO READ.	THE ENVIRONMENT AND ENVIRONMENTAL PROBLEMS.
14	READ FROM NEXT PAY.	PRESS NEXT PAGE BUTTON FROM EITHER SIDE.
15	READ FROM PREVIOU PAGE	PRESS PREVIOUS PAGE BUTTON FROM EITHER SIDE

S.O. AGYEI KADE PRESBY J.H.S. S.O.S MASTER

MY E/READER

PREVIOUS PAGE BUTTON
NEXT PAGE BUTTON
PREVIOUS PAGE BUTTON
NEXT PAGE BUTTON
5 WAYS CONTROLLER
CHARGER HOLE
POWER SWITCH
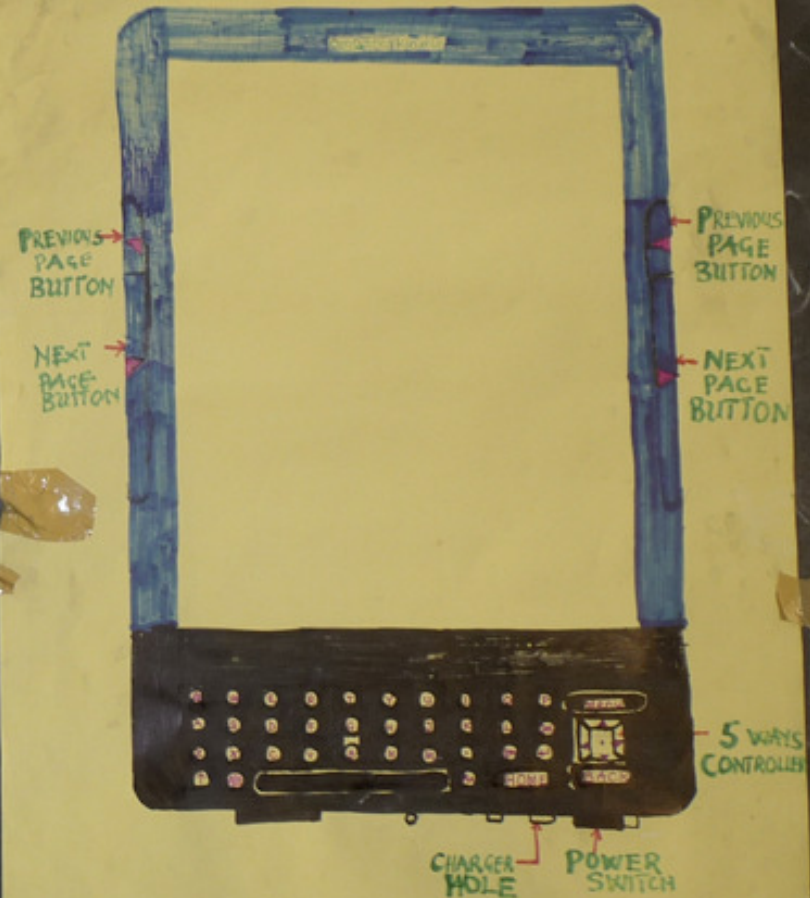
S.O. AGYEI KADE PRESBY JHS S.O.S MASTER

First 6 months of project

- Downloaded about 18000 free classics, newspaper samples, games

- Working way through ~ 35000 ebooks

✓ 50% more time reading (with ereaders)

✓ Test scores + 4.4% on average

✓ Reading comp. average + 13% (primary students)

✓ Language fluency and dictation improvement

First 6 months of project

TOP 5 DOWNLOADS

	Books	Magazines	Games
1	*The Holy Bible*	*Winding Road Weekly*	Every Word
2	*Beauty and the Beast*	*International Herald Tribune*	Shuffled Row
3	*Cinderella*	*The New York Times*	Minesweeper
4	*I Love You This Much: A Song of God's Love*	*The New Yorker*	Number Slide
5	*The Jungle Book*	*Newsweek*	Dots and Boxes
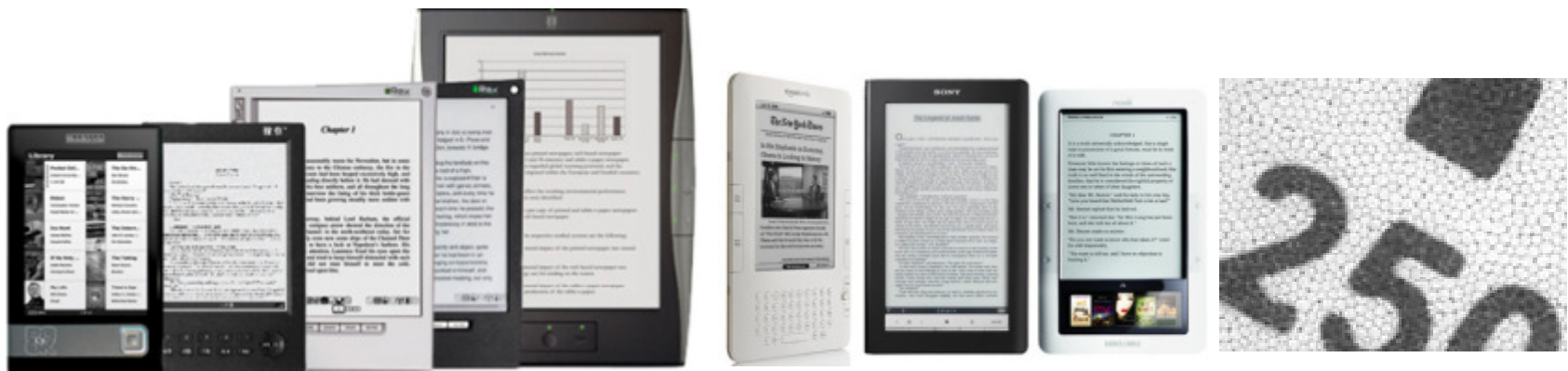
E-ink based ereaders for educational purposes

CASE STUDIES

Kindle DX study

- <u>Princeton University</u>
- Case Western Reserve University
- <u>Reed College</u>
- Arizona State University
- Pace University
- Darden School of Business, Virginia University
- <u>University of Washington</u>
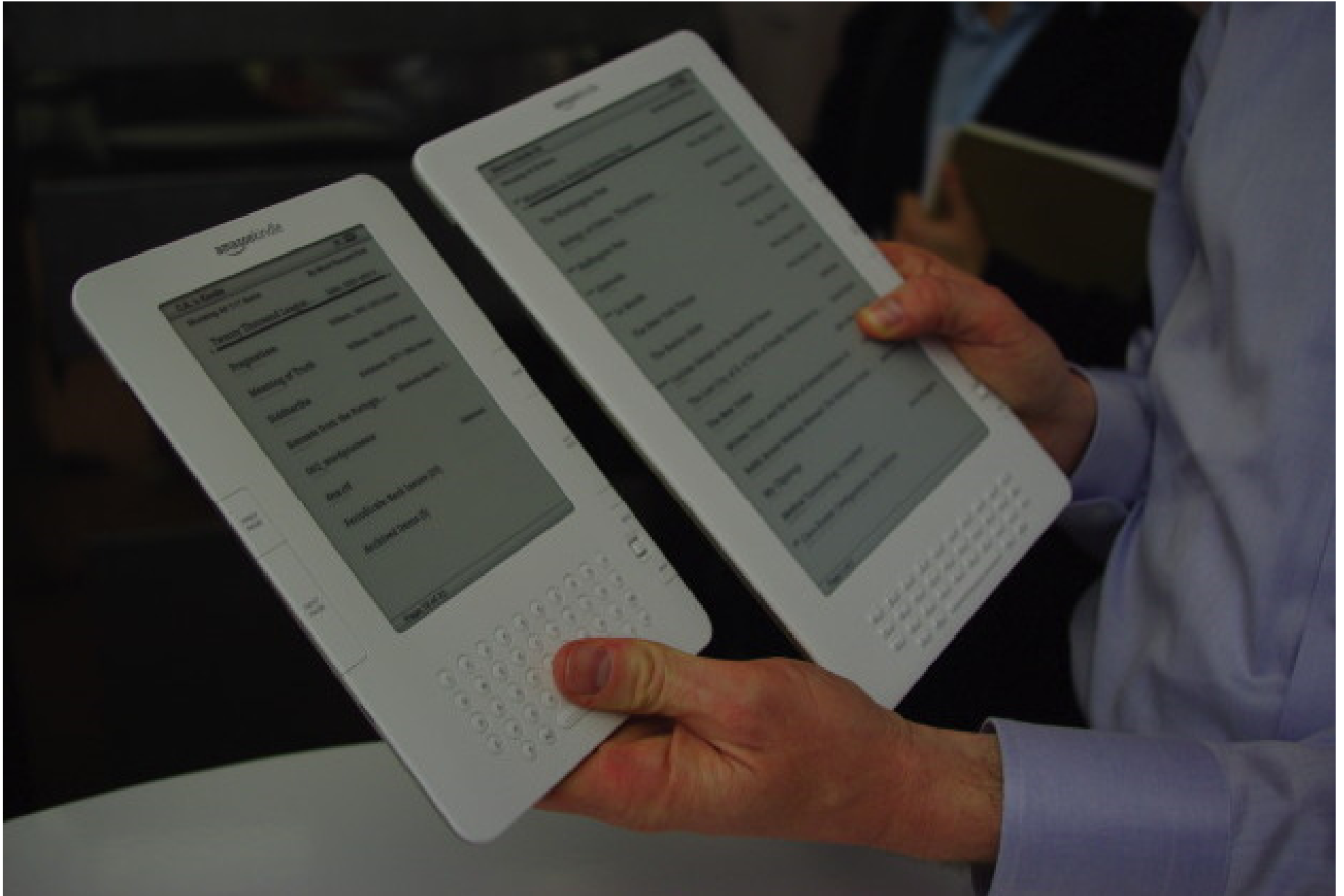
Kindle (left) vs. Kindle DX (right)

Kindle DX latest generation ($380)

Princeton University

1. Reduce printing & photocopying (3 courses)
2. Using tech. in the classroom equals (or betters) typical classroom experience?
3. Explore strengths & weaknesses of current e-reader technology

   (suggestions for future devices)

Princeton University

- Three courses (3 faculty, and 51 students)

✓ Goal of printing less in the pilot courses
  - Participants printed just over ½ amount of sheets than control groups

✗ Classroom experience somewhat worsened
  - Study & reference habits challenged by device limitations

Princeton University

- Pay more attention to
  - Annotation tools
  - Pagination
  - Content organization
  - More natural paper-like experience
- Most pleased with Kindle reading experiences
- ✖ <u>Writing tools</u> fell short of expectations

Princeton University

- 94% said they used less paper
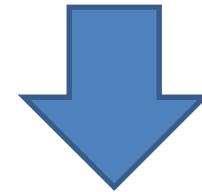
Course	Average paper use, Kindle owner	Average paper use, control group	Relative difference
WWS555a	962	1826	53%
WWS325	762	1373*	55%
WWS5xx with 24% enrollment of pilot participants	570	1508	38%**

*extrapolated from Fall '08 usage of 1144 sheets per person, with 20% per annum increase

** Kindle users in this class were well below the mean of their pilot peer group in WWS555a, apparently because they used the Kindle in two classes instead of one. There is little else to account for the difference.

Favourite features (Kindle)

- Battery life
- Wireless connection
- Portability
- All course reading on one device
- Ability to search for content
- Legibility of the screen
- Can be read in full sunlight

Areas of improvement (Kindle)

- Ability to highlight and annotate PDF files
- Improving the annotation tools
- Providing a folder structure
- **<u>Improving the highlighting function</u>**
- Improving the navigation within and between Kindle documents

Princeton University

- Superb annotation tools critical for success

- When told that additional features <u>would impact battery life</u>, most students prefer to stick with grayscale & e-paper, except:
  - <u>Highlighting</u>
  - <u>Addition of touch screen, stylus would be better</u>
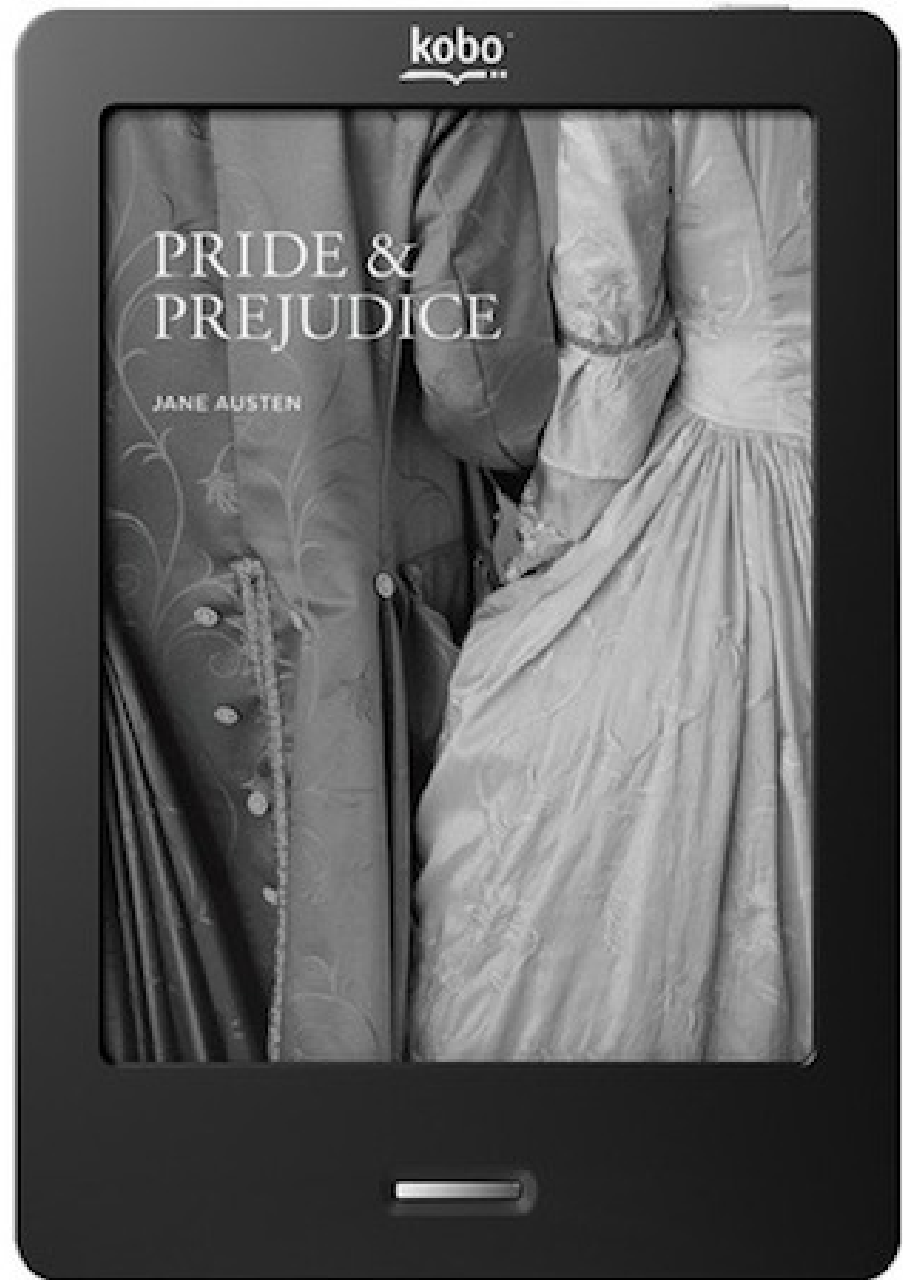
Kobo Touch, revealed May 2011
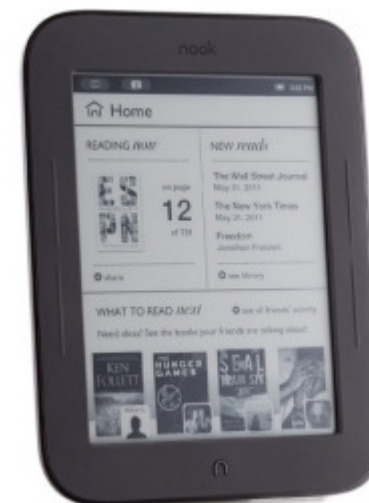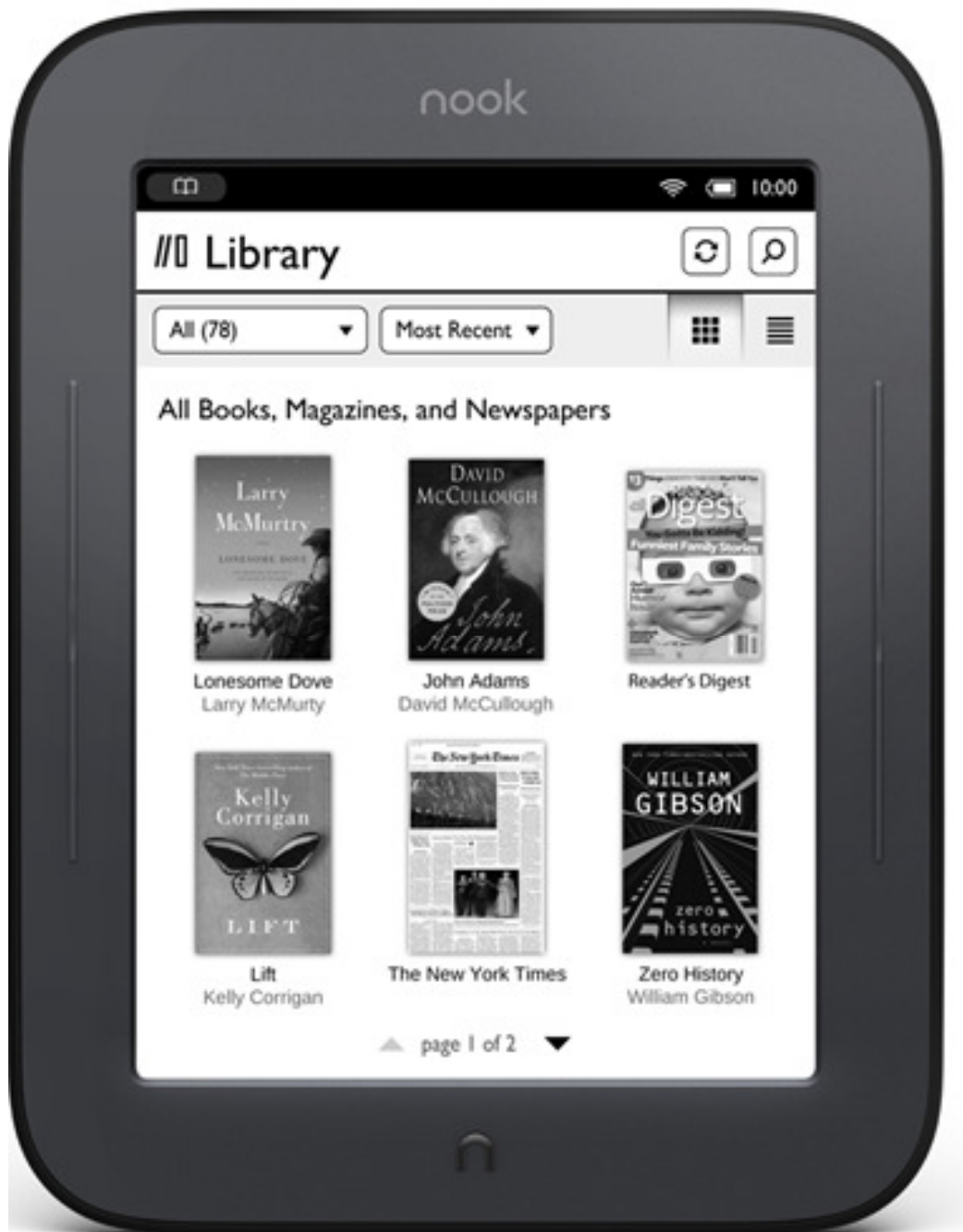
Nook Touch, revealed May 2011

Reed College

- ~40 students in 3 courses (upper division)
- Kindle DX to read texts and other materials

  (Also considered iRex iLiad, the Interead COOL-ER, the ECTACO jetBook, the Barnes & Noble nook, and several Sony Readers)

Goals

- Assess e-book technology for curricular use
- Identify impacts of technology on teaching & learning
- Identify features whose modification (or addition) <u>would improve usability</u> for curricular purposes

Reed College

Potential long-term benefits:

1. immediate, searchable <u>access</u> to materials
2. reduction in total <u>cost</u> of course materials
3. reduction in use of <u>paper</u>
4. opportunities to <u>share</u> electronic comments
5. integration of e-book technology with other curricular tools (e.g. Moodle, Reed's open source learning management system)

Reed College

- **English 301:** Junior Seminar in English
  - *Irony, Allegory, Epic, Novel*
- **French 451:** Special Topics in French Literature
  - *The History of Truth and Authenticity from Montaigne to Sartre*
- **Political Science 422:** Nuclear Politics
  - *The origins and effects of the spread of nuclear weapons*

Reed College

Participation and Benefits

- Entirely voluntary, paper versions available

- Participants receive Kindle DX

- Participants provide required feedback

- Allowed to keep Kindle DX at conclusion

Reed College - Benefits

1. Legibility (e-ink vs. LCD)

2. Form factor (comfort, workspace use)

3. Battery life

4. Durability

5. Paper savings (very promising)

6. Distribution (especially wireless)

7. Single-function benefit (specifically in class)

Legibility

- Eink, light contrast between text and less sharp than paper, read for many hours without visual fatigue

- Some expressed preference for the Kindle display

- Few felt (laptop) LCD displays as comfortable for reading text

Form factor

- Size, weight, general configuration
- Hold comfortably for many hours of reading
- Carry easily in backpacks
- Use in class without cluttering workspaces
- Smaller eReaders maybe be better for travelling but preferred the larger screen for academic use

Battery life

- Praise for "long distance" battery life
- Wireless feature turned off week or more without recharge

Durability

- Initial concern abut fragility of eReader (padded Kindle cover)
- Turned out to be quite durable, even with cover removed.

Paper savings

- Expected to cut down dramatically on printing, which proved to be the case
  - E.g. one course ~ 70 articles
- Most reported that able to read articles in PDF format on the Kindle well enough
- Many view this as most promising aspect of electronic materials

Over-the-air distribution

- Number of students indicated they purchased items (or acquired free texts) online for pleasure reading or other personal uses

- Delighted to be able to download a text in a minute or less

- Ease of browsing books in the store

- Wide selection of titles

- Lack of cell charges

- Speed of downloading texts from any location

- <u>Platforms that required a computer connection for text downloading seemed cumbersome by contrast</u>

Single-function benefit

- Discussion about long-term viability of single function devices (i.e. reading text).

- Faculty noted use of Kindle DX in class didn't lead to distractions are typical of laptop use

- <u>Functional limitations proved to be beneficial for class discussion dynamics</u>

Reed College - Challenges

- Materials availability
- <u>PDF formatting</u>
- <u>PDF distribution</u>
- Images and colour
- File system
- Page refresh and skimming
- Referring to texts in class
- <u>Highlighting and annotation</u>
- Content comprehension
- <u>Cost considerations</u>

Materials availability

- Not all readings could be obtained by Amazon
  - E.g. French literature course instructor had to provide most material (primarily public-domain etexts)
  - No integrated, searchable French-English dictionary would be available in addition to *New Oxford American Dictionary*

Materials availability

- Books available for other two courses, but not pref. edition.

- Students expected to read many journal articles (normally online through library's e-journal subscriptions)

- Limited capabilities of Kindle <u>web browser</u> (needed to convert articles)
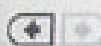
PDF formatting

- Can read PDFs but lose annotation, highlighting, text-resizing, text-to-speech, etc.
- Conversion required time, esp. for older articles
- Special care for footnotes, two-column page layouts, charts, and tables
- Conversion took at least an hour, often more

PDF distribution

- Amazon not involved in processing of assigned articles

- Faculty hesitant to store copies of articles on Amazon's servers (even temporarily, due to concerns about Fair Use)

- Uploaded to appropriate course areas in LMS

- Hence, PDF distribution cumbersome

Images and colour

- Relatively low screen resolution and greyscale display
  - Readings for study did not rely heavily on images or colour

File system

- "Home page" listed materials linear fashion.
  - Can be sorted alphabetically by author or title, or chronologically by the date last opened
- No organizing materials in conventional folder hierarchy.

new Poker Hands   Poker

new And Thereby Hangs a Tale   Jeffrey Archer

The Importance of Being Ear...   Oscar Wilde

new My Clippings

The Canterville Ghost   Oscar Wilde

Room   Emma Donoghue

The Cobra   Frederick Forsyth

Kindle User's Guide   Amazon

To the Lighthouse   Virginia Woolf

Native Son   Richard Wright

Page refresh and skimming

- No problem *if* search were easier & faster

- "Flipping through the pages" important

Referring to texts in class

- Courses centred around careful reading and discussion of assigned texts

- Expected to support their claims with specific textual evidence

- Use location numbers (font size & word density can be changed)

- Location numbers tied to specific points in texts (but difficult to reach with interface)

time and money.

CHASUBLE. Am I to understand then that there are to he no christenings at all this afternoon?

JACK. I don't think that, as things are now, it would be of much practical value to either of us, Dr. C

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Go to...

230|

(cover) (beginning) (location) (table of contents)

Referring to multiple texts

- One text at a time

- Hard to navigate smoothly between multiple texts (e.g. class use)

- Use of location numbers complicates citation

- Many gave up using Kindle in class

Highlighting and annotation

- Five-way controller
- Notes only at bottom of screen
- Highlighting less problematic, but still suffered (controller)

- Kindle **iPhone** uses similar structure, but **touch navigation**
- Same tasks in iPhone / Kindle (which took twice as long)

"Technology will need to match flexibility and ease of jotting notes on paper, flipping from page to page, and spreading multiple texts across a desk"
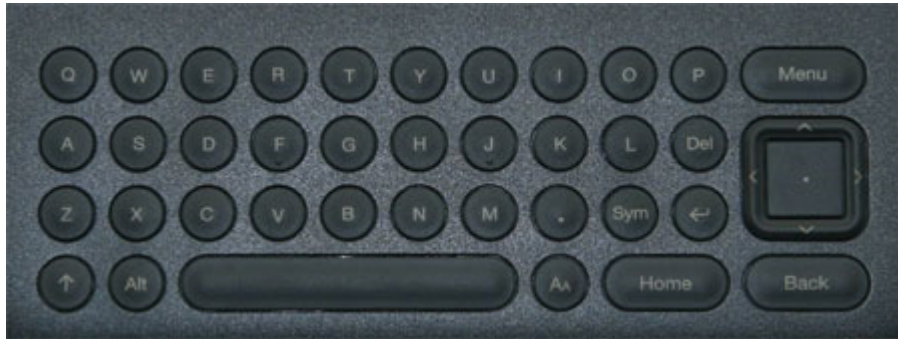
Five-way controller

Static footnote area

around them.

"Like I told you . . ." Collin pulled into the slow-moving vehicle lane to allow a short string of cars to pass him. "We're in northern Oregon now. We'll be heading into the Cascade Mountains in a few minutes. I just hope we can make it over without too much trouble. Ol' Queenie almost bought the farm going over the Rockies."

go·ing n. 1 an act or instance of leaving a place; a departure: his going left an enormous gap in each of   *more* ↵

Begin typing to create a note or click to start a highlight

Content comprehension

- Faculty member felt comprehension suffered
- Difficulty with highlighting and taking notes leads to passive reading
- Evidence in assignments & class discussion
- Faculty & students agreed:
  - issue is critical to academic use of eReaders
  - easily addressed by technology for quick and easy text highlighting and annotation, etc.

Cost Considerations

- At time of price of Kindle DX - $489.

- Others varied from $199 to $859

- Price needs to drop dramatically (< $100)

- Many would spend much more for <u>multi-function</u>

  – If it eliminated the need to own a laptop
  – If as comfortable as eReader for long reading

Reed College

- Students & faculty unanimous in reporting that Kindle DX (currently) was unable to meet their academic needs

- Many felt that once technical and other issues have been addressed, eReaders will play a significant, possibly a transformative, role in higher education

UNIVERSITY of WASHINGTON

ASU
ARIZONA STATE UNIVERSITY

CASE WESTERN RESERVE
UNIVERSITY

UNIVERSITY of VIRGINIA
DARDEN SCHOOL OF BUSINESS

PACE
UNIVERSITY

REED COLLEGE

PRINCETON
UNIVERSITY

University of Washington

- Broadly : how students did academic reading
  (those who incorporated e-reader into routines and those who did not)

- 39 1st-year graduate students in CS & Engineering, 7 women and 32 men, from 21 to 53 years old.

- 7 months into study, less than 40% of students were regularly doing academic reading on Kindle

  – Reasons included lack of support for <u>taking notes</u> and difficulty in <u>looking up references</u>

University of Washington

- [Professor Charlotte Lee](#) from UW's Department of Human Centered Design & Engineering
- Continued to interview students over nine-month period
- Reading habits, with or without the e-reader?

University of Washington

1. Most reading in fixed locations
   - 47 % at home, 25 % at school, 17 % on bus, 11% coffee shop or office

2. Kindle more likely to replace paper-based reading than computer-based reading

University of Washington

3. Continued to use the device
   - some read near computer to look up references
   - others, sheet of paper into the case for notes

4. With paper
   - ¾ marked up texts as they read
   - highlighting key passages, underlining, drawing pictures, notes in margins, etc.

University of Washington

5. Difficulty of switching between <u>reading techniques</u>, e.g. skimming illustrations or references before reading text

6. Cognitive mapping disrupted (physical cues to help retain and recall information)

University of Washington

Professor Charlotte Lee:

- Software will help address some issues over time
- Niche software for styles specific to certain disciplines?
- PCs, laptops, tablet, paper, will play role in academic reading
- eReaders will also find their place
- May be similar to today's music industry
- E-readers not where they need to be
- Improvement "sooner than we think."

LCD-based media tablets for educational purposes

CASE STUDIES

Pepperdine University

- Three-term study to assess iPad potential in education
1. Exploratory research to inform research design (fall 2010 & spring 2011)
2. Assess potential to enhance student learning outcomes (fall 2011)

- Compares technology use & engagement for students:
  - One section is loaned iPads
  - Other section uses various computing devices
  - Undergraduate and graduate courses

Pepperdine University

Data Collection

- Pre-term technology use survey
- Classroom observations
  - The use of the iPad/laptop/mobile devices by students
  - The structure of class time and teaching style
  - Students' activities during class
  - Group learning activities, etc.
- Focus groups with students.
- Post-term technology use survey
- Post-term interviews with participating faculty
- Collection of grades

Fall 2010	Spring 2011

Fall 2010

Calculus I
1. GraphCalc HD
2. Underscore Notify
3. Numbers
4. DropBox
5. Groupboard

Law School Course
1. Penultimate
2. Keynote
3. Quickoffice Connect
4. I-annotate PDF

Religion
1. Bible Reader for Bible Studies by Olive Tree
2. NRSV Bible Reader
3. Pocket Dictionary Biblical Studies
4. Carta Compact Atlas HD, Bible Maps

Spring 2011

Calculus 1
1. GraphCalc HD (Cost: $1.99)
2. Underscore Notify (Cost $1.99)
3. Numbers (Cost: $9.99)
4. DropBox (FREE)
5. Groupboard (FREE)

Nutrition
1. Wellness Dice
2. iAmino
3. Protein Rich foods
4. Nutrient Facts
5. My Nutrients
6. FoodTracker Pro
7. Calorie Tracker
8. Metabolic Syndrome
9. EatRight Daily Food Log

Business
1. Keynote
2. Pages
3. Numbers
4. Hotel Tycoon
5. iAnnotate PDF
6. Study.Net
7. DropBox

Part 1: Get to Know Keynote
Explore the toolbar.

Remote Settings

Enable Remotes ON

Darrell's iPhone Link

Linked remotes can control Keynote when a presentation is playing.

iPad

Presentations Undo

Presentations
Create new presentations and find the ones you've worked on before. Your progress is saved automatically as you work.

Undo
Anything you do can be undone with just one tap. Touch and hold to redo.

Toolbar buttons

Info: Change object or text properties.

Insert: Add a photo, table, chart, or shape.

Animation: Animate slides.

Tools: Search, check spelling, and more.

Play: Play your presentation.

My Spreadsheets   Undo   **mileage2010**   ℹ️   🖼️   🔧

| | Jan | Feb | Mar | April | May |

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Screenshot 1 — Organic Chemistry

BENZENE

- AROMATIC HYDROCARBON
- CONJUGATED DOUBLE BONDS
- KEKULÉ PROPOSED, 1865

- REPRESENTED AS:

Screenshot 2 — My Notebooks

Pyxis Project Notes

Dec 14, 2010 1:16 AM
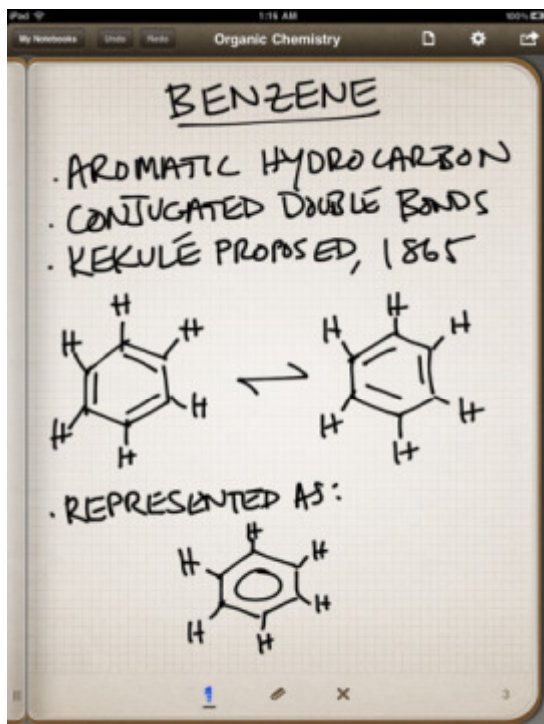
Screenshot 3 — Notes

MEETING NOTES   12/1

* AGENDA *
- DISCUSS CORPORATE MEMO POLICY
- INVESTIGATE RECENT THEFT FROM OFFICE INCLUDING PRINTER
- PRESENTATION RE: IMPORTANCE OF A RED SWINGLINE STAPLER AT EVERY DESK
- ANNOUNCE RECENT PROMOTIONS

* FOLLOW ON ITEMS *
- ☐ FIND 5 PIECES OF FLARE
- ☐ CALL THE BOBS
- ☑ RECORD TUTORIAL
- ☐ TYPE MEMO
- ☐ READ MEMO
- ☐ RECYCLE MEMOS
- ☑ WATER CHIA PET

Settings

Help | Done

Last healthy day	11/19/2009 ❯
New day starts at	9:11 AM ❯
Meal plan profile	Custom plan ❯
Icon theme	Default ❯

Milk and Dairy
1 cup = 1 serving

1 yogurt
1 slice of cheese
1 cup of skim milk
1/2 cup cottage cheese
1/2 cup pudding
1/2 cup ice cream

Meal Profile

Settings

Average female	
Average male	
Custom profile	✓

Grains	❯
Vegetables	❯
Fruits	❯
Milk and Dairy	❯
Meat and Protein	❯
Water	❯

+ Protein

Pepperdine University

How helpful was iPad for sharing information in class?

- ~75 % of students: very helpful or slightly helpful
- "We'll try to help each other to make sure we're all at the same page"
- "You're more likely to help each other when it's portable and you can see what each other is doing."
- Saw sharing of images, reference content (from apps and the Internet), and in-class notes

Pepperdine University

What is the value of the iPad?

- "The iPad can do everything"

- "Not just a clicker or an e-reader"

- Capacity to be a communication, productivity, and gaming device

Pepperdine University

What is the iPad's purpose?

- No specific purpose until **given** purpose

- [Tablets] no reputation as productivity tools

- Productivity apps not helpful until encouragement / guidance

- Gaming apps can be learning tools

What works?	What doesn't?	Why	Evidence
Student peer pressure *or* Faculty require use apps	Faculty encourage use or Apps used for homework	Most students will not take time to learn something new unless they have to	-Group work - Assignment to learn to use app - App required for test
Faculty member knows app well, encourages students to teach each other with class activities	Faculty member does not know how to use the apps required for their course	If faculty member is frustrated with app, most students won't even bother	- Quotes - Usage notes
Encourage use of iPad with everyday useful apps for note taking, email, PDF, eReaders, etc.	Jumping right into complex app use or assignments when students are not comfortable with the iPad	There is a learning curve to using the iPad	- Quotes

Oklahoma State University

- Fall 2010, five sections of two courses across two colleges and two campuses
- School of Media and Strategic Communications, School of Business

Oklahoma State University

Did the iPad increase or decrease expenses? ✓

- Evidence suggests decrease in student expenses
(with maximum integration)

- eBooks less expensive than traditional textbooks

- Saving could cover hardware costs in 2 semesters

- Possible decreased paper and printing costs

- Cloud computing could reduce future network storage needs

Oklahoma State University

How was iPad used (students and faculty)**?**

- Professional & personal benefits

- Students used iPad in ways outflanking PC

- Substitute for paper and pen

- Faculty can explore & recommend apps

- Built-in browser – web more readily available

Oklahoma State University

Integration of eReader enhancement or detraction?

- Mixed responses
- Students liked using iPad to **house their textbooks**
- Students suggested it promoted more reading
- However, e-book reading decreased
- Students thought would use iPad as e-reader, but didn't do as much as planned

Oklahoma State University

Integration of iPad an enhancement to the academic experience?

- 75% agreed or strongly agree with: **"I think the iPad enhanced the learning experience of this course"**
  - 92.8 % among students who owned a Mac
  - 70.4 % among students who owned a PC

- ~3% (in one course): opt out of iPad course for identical course without iPad

Oklahoma State University

Integration of iPad an enhancement to the academic experience?

- Faculty perspective:
  - uniform hardware and software available
  - knew students had access to same learning tools
  - above critical when planning assignments, activities

Oklahoma State University

"Because of the overall improvements to the academic experience of both faculty and students it is our recommendation the University should consider the full deployment of iPads for all students"

The urgent need for books in African schools

TEXTBOOKS

Need for books in African schools

- Textbooks 2nd most important factor in a good education in Africa
  - ahead of teacher training and the number of pupils in a class.
  - only "home background" of pupils proved to be more important.

Book Aid International

Home   News   **Books Change Lives**   Donate   Get involved   Schools   Our Work

Books Change Lives

books change lives

Donate

Reverse Book Club

Books Change Lives

We believe that books change lives. View one of our short films below to find out how.

You can make a donation to our Books Change Lives campaign by clicking here. For every £6, we will be able to send 3 more books to libraries like those featuring in the films below. If you'd like to order these films on DVD for an event e-mail us or call 0207 7333577.

Books have changed the lives of all the people below - click on a photograph to find out more!

Book Aid International

- Increases access to books
- Literacy, education & development in sub-Saharan Africa
- 507,787 new books to over 2,000 libraries in 2010
- More than 30 mil. books to partner libraries since 1954
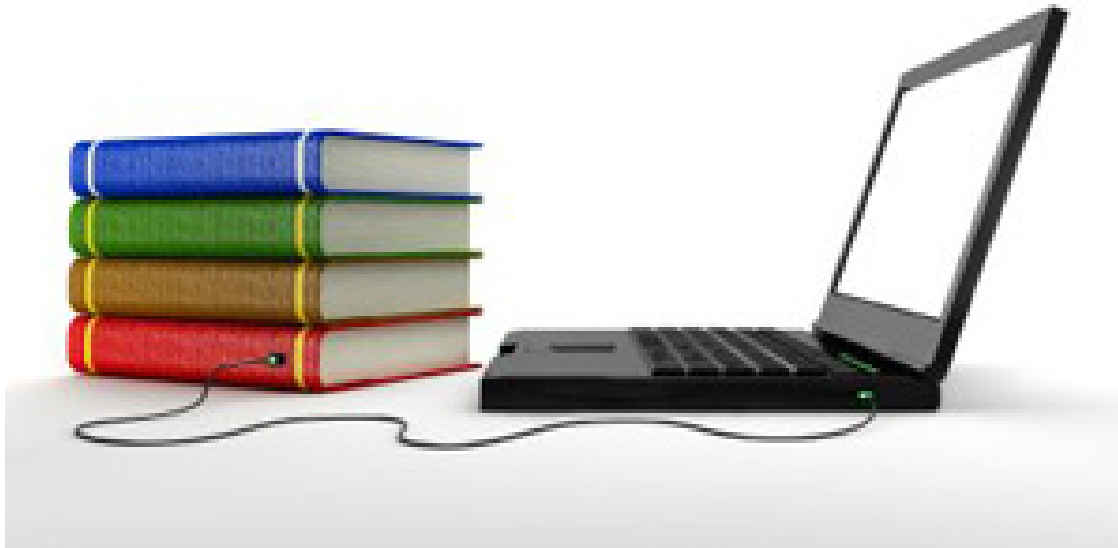
LIBRARY HOURS

WEDNESDAYS 3.00 – 4.00pm

SATURDAYS 9.30 – 10.30am

Hogsback, Eastern Cape

Ebooks as textbooks - challenges

- Electricity
  - Africa - 4% of world's electricity
  - 16, 000 schools in content without electricity
- Equipment capability (e.g. smartphone %)
- Government fiscal policies
- Security (copyright and piracy concerns)

Thank you! Comments or questions?

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