Tablets help students learn more material faster. Technology-based instruction can reduce the time students take to reach a learning objective by 30-80%, according to the US Department of Education and studies by the National Training and Simulation Association. [6]

81% of K-12 teachers believe that "tablets enrich classroom education." The survey of technology in the classroom by the Public Broadcasting Service (PBS) also concluded that 77% of teachers found technology to "increase student motivation to learn." [7]

Tablets can hold hundreds of textbooks on one device, plus homework, quizzes, and other files, eliminating the need for physical storage of books and classroom materials. The average tablet contains anywhere from 8 to 64 gigabytes (GB) of storage space. On the Amazon Kindle Fire, for instance, 1,000 books take up one GB of space. [8]

E-textbooks on tablets cost on average 50-60% less than print textbooks. According to a 2012 report from the Federal Communications Commission (FCC), K-12 school districts spend more than $8 billion per year on textbooks. [6] E-textbooks can save schools between $250-$1,000 per student per year. [9] Tablet prices also continue to drop, making them increasingly affordable. Tablets cost on average $489 in 2011, $386 in 2012, and are projected to cost $263 in 2015. [10][11]

Tablets help to improve student achievement on standardized tests. Publisher Houghton Mifflin Harcourt tested an interactive, digital version of an Algebra 1 textbook for Apple's iPad in California's Riverside Unified School District. Students who used the iPad version scored 20 percent higher on standardized tests versus students who learned with traditional textbooks. [4]

Handheld technological devices including tablets are associated with a range of health problems. Handhelds contribute to Computer Vision Syndrome, which causes eyestrain, headaches, blurred vision, and dry eyes, according to the American Optometric Association. [20] People who use mobile devices more often have a higher incidence of musculoskeletal disorders associated with repetitive strain on muscles, including carpal tunnel syndrome, neck pain ("text neck"), shoulder pain, and fibromyalgia. [21] [22]

Using tablets is more expensive than using print textbooks. Implementing tablets in K-12 schools requires purchasing hardware (the tablet) and software (the textbooks), building new wi-fi infrastructure, and training teachers and administrators how to use the technology. Implementation costs for e-textbooks on iPad tablets are 552% higher than new print textbooks in an average high school. Lee Wilson, a prominent education marketing expert, estimated the annual cost per student per class with tablets to be $71.55 vs. $14.26 for print textbooks. [23]

Tablets have too many distractions for classroom use. Students may pay attention to apps, email, games, and websites instead of their teachers. 87% of K-12 teachers believe that "today's digital technologies are creating an easily distracted generation with short attention spans." [24] Four-fifths of students aged 8 - 18 multitask while using digital media. [25]

People who read print text comprehend more, remember more, and learn more than those who read digital text. The brain interprets printed and digital text in different ways, and people generally read digital text 20-30% slower than print. [26] [27] According to Pulitzer Prize winning technology writer Nicholas Carr, peer-reviewed studies show that reading hyper-linked text may increase the brain's "cognitive load," lowering the ability to process, store, and retain information, or "translate the new material into

Tablets contain many technological features that cannot be found in print textbooks. Tablets give users the ability to highlight and edit text and write notes without ruining a textbook for the next user. Tablets have a search function, a backlighting option to read in low light, and a built-in dictionary. Interactive diagrams and videos increase student creativity, motivation, attentiveness, and engagement with classroom materials.

Print textbooks are heavy and cause injuries, while a tablet only weighs 1-2 pounds. Pediatricians and chiropractors recommend that students carry less than 15% of their body weight in a backpack, but the combined average weight of textbooks in History, Mathematics, Science, and Reading/Language Arts exceeds this percentage at nearly all grade levels from 1-12. [12] According to the US Consumer Product Safety Commission, during the 2011-12 school year more than 13,700 kids, aged 5 to 18, were treated for backpack-related injuries. [5]

Tablets help students better prepare for a world immersed in technology. Students that learn technology skills early in life will be better prepared to pursue relevant careers later in life. The fastest growing and highest paying jobs in the United States are technology intensive. Employment in "computer and information systems" is expected to grow by 18% between 2010-20, according to the US Bureau of Labor Statistics. [13]

On a tablet, e-textbooks can be updated instantly to get new editions or information. Schools will not have to constantly purchase new hardware, software, or new physical copies of textbooks. FCC Chairman Julius Genachowski and Secretary of Education Arne Duncan said that "too many students are using books that are 7-10 years old with outdated material." Tablets are especially beneficial for subjects that constantly change, such as biology or computer science. [6]

conceptual knowledge." [28] In addition, students who type lecture notes instead of write their notes by hand tended to write more, process less, and perform worse on recall tests.[52]

Many students do not have sufficient home internet bandwidth to use tablets. Students "need home broadband to access digital content and to complete Internet based homework," according to FCC Chairman Julius Genachowski and Secretary of Education Arne Duncan, but about a third of Americans – 100 million people – do not have broadband internet at home. [6] A 2010 FCC survey found that nearly 80% of K-12 schools reported broadband connections that were "inadequate to meet their current needs. [47]

Manufacturing tablets is environmentally destructive and dangerous to human health. According to the *New York Times*, the "adverse health impacts from making one e-reader are estimated to be 70 times greater than those from making a single book." One tablet requires the extraction of 33 pounds of minerals, 79 gallons of water, and 100 kilowatt hours of fossil fuels resulting in 66 pounds of carbon dioxide. Print books produce 100 times fewer greenhouse gases. Two gallons of water are required to make the pulp slurry that is pressed and heat-dried to make paper, and only two kilowatt hours are required to form and dry the sheets of paper. [3]

A broken tablet requires an experienced technician to fix, which can be costly and time-consuming. Textbooks can usually be repaired with basic supplies such as glue or tape.

Print textbooks cannot crash, freeze, or get hacked. Unlike tablets, there is no chance of getting malware, spyware, or having personal information stolen from a print textbook.

The average battery life of a tablet is 7.26

Tablets lower the amount of paper teachers have to print for handouts and assignments, helping to save the environment and money. A school with 100 teachers uses on average 250,000 pieces of paper annually. [14] A school of 1,000 students on average spends between $3,000-4,000 a month on paper, ink, and toner, not counting printer wear and tear or technical support costs. [15]

Tablets allow teachers to better customize student learning. There are thousands of education and tutoring applications on tablets, so teachers can tailor student learning to an individual style/personality instead of a one-size-fits-all approach. There are more than 20,000 education apps available for the iPad alone. [16]

Files on one tablet can be downloaded onto any other tablet, increasing flexibility and convenience for teachers and students. E-textbooks and other files can be stored on "cloud" servers and accessed on any equivalent device. Users can sign into an account on a different device and access all of their information.

High-level education officials support tablets over textbooks. Secretary of Education Arne Duncan and Federal Communications Commission chair Julius Genachowski said on Feb. 1, 2012 that schools and publishers should "switch to digital textbooks within five years to foster interactive education, save money on books, and ensure classrooms in the US use up-to-date content." The federal government, in collaboration with several tech organizations, released a 70-page guide for schools called the "Digital Textbook Playbook," a "roadmap for educators to accelerate the transition to digital textbooks." [6]

Students who own tablets purchase and read more books than those who read print books alone. The average tablet-owning

hours, shorter than the length of a school day. Tablets constantly need charging, increasing electricity demands on schools and the need for new electrical outlets. [29]

Tablets are more susceptible to theft than print textbooks. In San Francisco, New York, and Los Angeles, robberies related to internet-enabled handheld devices (including tablets) have accounted for 50, 40, and 25 percent respectively of all robberies in 2012. Stolen and lost internet-enabled handheld devices have cost Americans more than $30 billion in 2012. [30]

Tablets enable students to cut corners or cheat on schoolwork. Students can easily avoid reading and analyzing texts on their own because they can quickly look up passages in an e-textbook and search for answers on the internet.

The higher cost of tablets marginalizes poorer school districts and increases the "digital divide." Rich school districts can afford to implement e-textbooks on tablets, while poor school districts cannot. Low income schools are less likely to implement an e-textbook program than to pay for teachers or basic classroom supplies.

Tablets increase the number of excuses available for students not doing their schoolwork. Students have new available excuses, including: "the tablet broke/froze," "I forgot the tablet at home so I can't do schoolwork today," and "I couldn't find my charger."

Tablets shift the focus of learning from the teacher to the technology. This change marginalizes decades of learned wisdom in the teaching profession in favor of an unproven technology. According to education reformer Mike Schmoker, until the core elements of literacy and critical thinking are learned by every student, "it makes little sense to adopt or learn new programs,

US student reads 24 books per year on a tablet compared with 15 in print for those who do not own a tablet. [17] According to a survey by the Pew Internet and American Life Project, 30% of e-content readers (including 40% of those under age 30) say that they now spend more time reading than they used to due to the availability of e-content. [18]

Using a tablet is so intuitive that it makes learning fun and easy. In two isolated rural villages in Ethiopia, the One Laptop Per Child organization dropped off closed boxes containing tablets pre-loaded with educational apps, taped shut, with no instruction. Within five days, elementary school-age students without prior education were using 47 apps per child, per day. Within two weeks, they were singing ABC songs, and within five months they had successfully hacked the tablet's operating system and customized the desktop settings. [19]

technology, or any other innovations." Technology gets in the way and makes learning and teaching more burdensome. [31]

Many textbooks are not available in digital format or on the specific tablet used by a school. As of 2012, only 30% of textbook titles are available electronically. There are many different companies that manufacture tablets, and most contract with one specific e-book seller. This means that some textbooks may not be sold across all tablets. [32] [33] [34]

Tablets may be too difficult for less-technologically-savvy students to operate. When Daytona State College conducted an electronic textbook focus group, the most common reason given for withdrawing from the group was "I did not feel that I had the technical ability to read or reference my textbook from a computer." [35]

Tablets are unnecessary because print textbooks that are not brand new still convey relevant information to K-12 students. A K-12 student learning from an older print textbook still learns the basics of anatomy, physics, algebra, geometry, and the US government.

Background of the Issue

Which is better for these purposes, a printed book or an e-book?
% of those who have read both e-books and printed books in the last 12 months who say that this format is better for these purposes
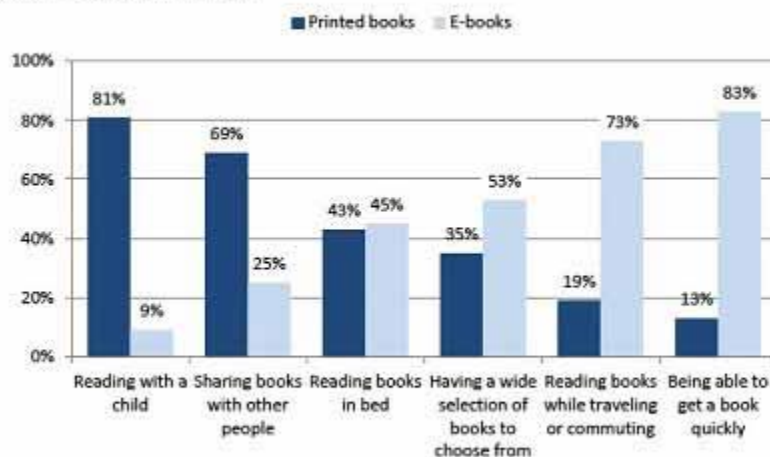
Source: Pew Research Center's Internet & American Life Reading Habits Survey, November 16–December 21, 2011. N=2,986 respondents age 16 and older. Interviews were conducted in English and Spanish and on landline and cells. N for those who have read both printed books and e-books in the past 12 months is 701.

(click to enlarge image)

Publishing for the K-12 school market is an $8 billion industry, with three companies - McGraw-Hill, Pearson, and Houghton Mifflin Harcourt - capturing about 85% of this market. [32] Tablets are a $72 billion industry with 42% of US adults owning a tablet. [33][34] As tablets have become more prevalent, a new debate has formed over whether K-12 school districts should switch from print textbooks to digital textbooks on tablets and e-readers.

Proponents of tablets say that they are supported by most teachers and students, are much lighter than print textbooks, and improve standardized test scores. They say that tablets can hold hundreds of textbooks, save the environment by lowering the amount of printing, increase student interactivity and creativity, and that digital textbooks are cheaper than print textbooks.

Opponents of tablets say that they are expensive, too distracting for students, easy to break, and costly/time-consuming to fix. They say that tablets contribute to eyestrain, headaches, and blurred vision, increase the excuses available for students not doing their homework, require costly Wi-Fi networks, and become quickly outdated as new technologies are released.

2012 marked the first time that more people accessed the Internet via smartphones and tablets than desktop or laptop computers. [37] By Jan. 2014, 42% of US adults owned a tablet computer, 32% owned an e-book reader, and 50% owned one or the other (up from 29% in Aug. 2012), according to a survey by the Pew Research Internet Project. [18] Approximately 227 million tablets were shipped in 2013, and that number is projected to increase to 386 million by 2017. [38] A joint report by McKinsey and the GSMA predicts the mobile education market could be worth $70 billion globally by 2020, and predicts demand for mobile education devices, like smartphones and tablets, may be worth another $32 billion by the same time frame. [38]

43% of Americans read online books, magazines, or newspapers. [18] Amazon announced in July 2010 that e-books were outselling paper books, and a July 2012 report by the Association of American Publishers showed that e-book revenue exceeded that of hardcover books for the first time ever. [33] From 2008 to 2012, e-book sales rose from $68 million per year to $3 billion. [34] While e-books sales rose 117% from 2010 to 2011, the print book business declined 2.5% in 2011 to $27.2 billion from $27.9 billion in 2010. [33] However, over 90% of educational textbooks are still read on paper, and only 30% of textbook titles are available electronically. [36]

In Nov. 2010, the US Department of Education released its National Education Technology Plan, a detailed blueprint on how schools can improve learning with technology. Among its recommendations is to leverage mobile devices ("the technology students already have") in the classroom. In his Jan. 2011 State of the Union address, President Obama said, "I want all students to be able to learn from digital textbooks." On Feb. 1, 2012, the US Department of Education and the Federal Communications Commission (FCC), in collaboration with several tech organizations, released a downloadable "Digital Textbook Playbook" to "encourage collaboration, accelerate the development of digital textbooks and improve the quality and penetration of digital learning in K-12 public education." [6]

99,000 K-12 schools spend $17 billion annually on instructional materials and technology. Many districts, schools, and states have begun transitioning their instructional materials from paper textbooks to digital learning environments, according to the "Digital Textbook Playbook." Florida has mandated that all K-12 instructional materials are required to be provided in electronic format by 2015-2016. California launched a free digital textbooks initiative in 2009, and West Virginia replaced social studies print textbook

purchases with digital textbooks. Georgia state law requires that electronic copies of K-12 textbooks be made available for use by students, and the San Diego Unified School district has distributed 78,000 digital textbooks to teachers and students since 2011 and purchased 26,000 iPads for district use in June 2012. [6] In June 2013, the Los Angeles Unified School District (LAUSD; the second-largest school district in the country) approved an estimated $1 billion plan to purchase 640,000 iPads with Pearson curricula for all of the K-12 students in the district.[49] [50] [51] The school district spent $61 million to purchase 47,000 iPads before the contract was suspended on Aug. 26, 2014 due to allegations of impropriety in the bidding process. LAUSD plans to re-bid the tablets project. [49] [50]

(click to enlarge image)
Drawing of a child carrying an overstuffed backpack.
Source: Back to Life Chiropractic, "Is a Heavy Backpack Weighing Down Your Child?," b2lchiropractic.wordpress.com, Aug. 16, 2012

The percentage of K-12 classrooms with internet access has increased from 51% in 1998 to 98% in 2012, and 40% of elementary school teachers use computers during in-class instruction. Several meta-studies on the use of computer technology in the classroom show a small but statistically significant increase in learning outcomes. [17] Nineteen percent of children ages 2-5 in the United States, Canada, Japan, Australia, New Zealand, Czech Republic, France, Spain, Italy, Germany, and the UK can use a smartphone application. By comparison, 9% can tie their own shoelaces. More children ages 2-5 can open a web browser (25%) than swim unaided (20%). 20% of children ages 6-9 use email, and 14% are on Facebook. [40] A study by Nielsen Mobile Insights found that 53% of blacks and 57% of Latinos are smartphone users, well above the 45% rate of non-Hispanic whites. [41] Blacks and Hispanics are more than twice as likely to use Twitter and rely on mobile phones as a primary connection to the Internet than whites. [42][43]

The American Association of Publishers says that the average net unit price of a K-12 print textbook was $65 in 2010. [44] A 2005 report by Congress' Government Accountability Office found that print textbook prices nearly tripled from 1986 to 2004, rising at twice the rate of inflation. [45] A report from the Student Public Interest Research Group found that textbook wholesale prices have risen nearly four and a half times the rate of inflation from 1990-2009. [46] Digital textbooks on average cost 50-60% less than new print textbooks. Tablets in the United States cost on average $489 in 2011, $386 in 2012, $343 in 2013, and are projected to cost $263 in 2015. [10][11] However, implementation costs for e-textbooks on iPad tablets are 552% higher than new print textbooks in an average high school, and the annual cost per student per class with tablets is $71.55 vs. $14.26 for print textbooks. [23] This difference is due to additional costs associated with building wi-fi infrastructure, training teachers and administrators how to use the technology, and annual publisher fees to continue using e-textbooks.

According to an Apr. 2012 peer-reviewed study in *Archives of Disease in Childhood*, the average weight

of a student's backpack is 15.4 pounds (an average of 3-4 books), and the average weight of a tablet is between 0.75 to two pounds. [5] Pediatricians and chiropractors recommend that students not carry more than 15% of their body weight in a backpack, but an Apr. 14, 2004 study by the State of California found that the combined average weight of textbooks in just the four core subjects of History-Social Science, Mathematics, Reading/Language Arts, and Science exceeded this percentage at nearly all grade levels from 1-12. [12] According to data from the United States Consumer Product Safety Commission, over the period from 1994-2000 more than 23,000 youths ages 6 to 18 were treated in emergency rooms for backpack-related injuries, such as contusions, sprains and strains to the back and shoulders, and fractures. California and Georgia are the only states with legislation related to textbook size and weight, according to the Association of American Publishers. [48] In California, the maximum weight for a textbook is three pounds for grades K-4, four pounds for 5-8, and five pounds for 9-12. [39]