

**Testimony before the  
United States House of Representatives  
Committee on Education and the Workforce  
Subcommittee on Higher Education and Workforce Training**

Richard Baraniuk  
Rice University  
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**Access. The Future of Education.  
*OpenStax College***



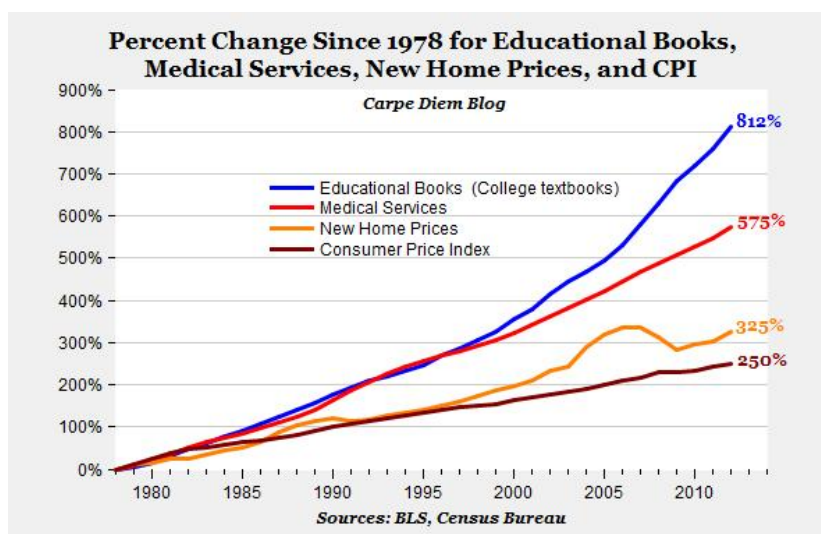
**SUMMARY**

In 1911, Andrew Carnegie joined a movement to make knowledge more accessible by institutionalizing the free public library as a resource for lifelong learning for millions of people. One hundred years later, technological advances have fueled a new disruption, with ramifications now not only for access and efficiency, but also for efficacy. Since 1999, Rice University has offered free educational resources via *Connexions*, a powerful e-textbook authoring and distribution platform. Within the next two years, Rice's *OpenStax College* will complete a library of 25 free, high-quality, on-line textbooks for the highest impact college courses. All of the books will be available for free in *Connexions* and on the OpenStax College website. At scale, OpenStax College will save an estimated 1.2 million students approximately \$120 million *each year*.

## THE ACCESS CRISIS

We tend to believe that all students have the opportunity to earn a college degree through hard work in high school and college. But because of record-high financial barriers, hard work is often not enough.

The high – and rapidly rising – cost of traditional textbooks is a significant barrier to enrollment, persistence and success for millions of post-secondary students (see Figure 1). According to the GAO, first-time, full-time college students spent an average of \$886 at two-year public colleges on books and supplies in 2003-2004, the equivalent of 72% of their tuition and fees. In some locales (California community colleges, for example), the cost of textbooks now exceeds the cost of tuition. No wonder a recent survey [R] found that 70% of college students forgo buying texts, even though 78% of those students believe they will perform worse in the course. The survey also found that 24% of students take fewer credit hours due to the cost of textbooks. Considering that 29% of community college students have an income under \$20,000, textbook costs can be a significant barrier to enrollment, persistence, and performance.



**Figure 1:** Percent changes for the three Consumer Price Index (CPI) series “Educational Books and Supplies,” “Medical Services,” and “All Items” and the median price for new homes from the Census Bureau. Since 1978 textbook costs have risen more than *three times* the average increase for all goods and services [P].

## OPENSTAX COLLEGE

Since 1999, Rice University has been developing new ways and means of addressing the access crisis, starting with the Connexions open education platform ([cnx.org](http://cnx.org), more information below). OpenStax College (see [openstaxcollege.org](http://openstaxcollege.org)) is harnessing this experience and expertise to build a library of twenty-five free, high-quality textbooks for the highest impact college courses (that combine high

enrollments with high textbook costs); see Table 1. In contrast to current textbook prices that in some subjects are approaching \$300, this library of titles will be available for *free* to all students 100% of the time.

**Table 1:** Top 25 college courses based on U.S. annual enrollment.

<b>Psychology</b>
<b>Economics</b>
<b>US History</b>
<b>Introduction to Sociology</b>
<b>College Algebra</b>
<b>Chemistry</b>
<b>American Government</b>
<b>Intermediate Algebra</b>
<b>Basic Math</b>
<b>Elementary Algebra</b>
<b>Pre-calculus (Algebra &amp; Trigonometry)</b>
<b>Introduction to Spanish</b>
<b>Management</b>
<b>Calculus</b>
<b>Non-Majors Biology</b>
<b>Astronomy</b>
<b>Accounting</b>
<b>Introduction to Business</b>
<b>College Physics</b>
<b>Biology</b>
<b>Statistics</b>
<b>Microbiology</b>
<b>Physics-Calculus Based</b>
<b>Finite Mathematics</b>
<b>Anatomy and Physiology</b>

OpenStax College textbooks are professionally authored and of the same quality as a traditional publisher’s textbook. Packaging high-quality, turn-key educational content in a form familiar to faculty is critical to its widespread adoption. In OpenStax College, both the textbooks and the accompanying ancillaries (solutions manual, image libraries, lecture slides, test bank) are available in widely accepted digital formats, including free webview, PDF, and e-book formats and low-cost print.

OpenStax College published its first five open textbooks starting in June 2012 (see Figure 2). These texts, featuring professionally developed, peer-reviewed content under the guidance of prestigious editorial boards, have been met with positive media reaction [M]. As of September 2013, adoptions have increased to over 335 institutions representing 50,000 students at community colleges, four-year

colleges, and research universities. In addition to formal adoptions, the texts have been downloaded from the OpenStax College website more than 250,000 times and used on the web by over 2 million unique learners. Together, formal and informal adoptions have already saved students in excess of \$4.6 million, which exceeds the cost of developing the texts. Six more textbooks will publish over the next 18 months (see Figure 2).



**Figure 2:** Phase 1 and Phase 2 OpenStax College titles with publication dates.

OpenStax College has fostered an ecosystem of for-profit and non-profit partners (companies providing computer-based homework sets, for example) that both help drive adoption and provide a way to return revenue to sustain the initiative long term. Current partners include Apple, John Wiley and Sons, Sapling Learning, WebAssign, Expert TA, Veritas Tutors, SimBio and the University of Michigan.

OpenStax College is exploring partnerships with Massively Open Online Course (MOOC) providers such as edX and Coursera to reduce barriers to student learning in online settings. One example is the Coursera Introductory Biology MOOC from UC Irvine [1]. (Beware that the term “open” in MOOC denotes “open enrollment” and not necessarily that the learning resources are open licensed or even free. Indeed, some MOOCs require or suggest that students purchase an expensive traditional textbook as part of the course.)

The cost of authoring, marketing, and maintaining the OpenStax College textbooks has been underwritten by Rice University and by grants from philanthropic foundations, including the William and Flora Hewlett Foundation, the Bill and Melinda Gates Foundation, the Laura and John Arnold Foundation, the Twenty Millions Minds Foundation, the Maxfield Foundation, the Calvin Kazanjian Foundation, the Leon Lowenstein Foundation. In return for the foundations’ venture philanthropic investment, OpenStax College aims to make returns in terms of student savings. The return on investment can be dramatic. With even modest market penetration, free, high-quality textbooks can produce benefits many times the value of an equivalent sum invested in scholarships. A one-time investment to create a textbook produces student savings year after year; a scholarship must be funded annually. More specifically, assuming just a 10% market share, the 25-title OpenStax College library will save 1.2 million students over \$120 million every year.

## THE OPEN ROAD AHEAD

We live in an increasingly connected world, yet our educational systems cling to the disconnected past. Moving forward, OpenStax College will enable not only student savings but also new mechanisms to democratize education by interconnecting ideas, learners, and instructors in new kinds of constructs that replace traditional textbooks, courses, and certifications. More generally, the open education movement has real potential to realize the dream of providing not only universal access to all of world's knowledge but also all the tools required to acquire it. The result will be a revolutionary advance in the nation's and world's standard of education at all levels. And the "perfect storm" resulting from the combination of the global financial downturn and powerful new communication and information technologies means the future will likely arrive much sooner than we think. Clearly the education world is in for a turbulent, yet fruitful next decade.

## APPENDIX: OPEN TEXTBOOKS AND CONNEXIONS

The textbook was the answer to the educational challenges of the 19th century, but it is the bottleneck of the 21st century. The textbook of today remains static, linear in organization, time-consuming to develop, soon out-of-date, and expensive. Moreover, a textbook provides only "off the rack" learning that doesn't cater to the background, interests, and goals of individual students. Communication and information technologies give us a golden opportunity to reinvent the textbook.

Open Educational Resources (OER) include text, images, audio, video, interactive simulations, problems and answers, and games that are free to use and re-use in new ways by anyone around the world. The key elements of OER are:

- *open copyright licenses* like the Creative Commons licenses ([creativecommons.org](http://creativecommons.org)) that turn educational materials into living objects that can be continuously developed, remixed, and maintained by a worldwide community of authors and editors; and
- *information technologies* like the Internet and Web, which enable easy digital content re-organization and virtually free content distribution.

The OER approach to textbooks provides several key opportunities, including:

- bringing *people* back into the educational equation. Those who have been "shut out" of the traditional publishing world, like talented K-12 teachers, community college instructors, and scientists and engineers in industry can add tremendous diversity and depth to the educational experience.
- reducing the high *cost* of teaching materials. In many US states, college students now spend more on textbooks than tuition.

- reducing the *time lag* between producing learning materials and getting them into students' hands. Many books are already out-of-date by the time they are printed. This is particularly problematic in fast-moving areas of engineering, science, and medicine.
- enabling *re-use*, re-contextualization, and customization such as translation and localization of course materials into myriad different languages and cultures. This is critical if we are to reach the entire world's population, where clearly "one size does not fit all" for education.

Several OER projects are already attracting millions of users per month. Some, like MIT OpenCourseWare ([ocw.mit.edu](http://ocw.mit.edu)) are top-down-organized institutional repositories that showcase their institutions' curricula. Others, like Wikipedia ([wikipedia.org](http://wikipedia.org)), are grassroots organized and encourage contributions from all comers.

In 1999, Rice University founded Connexions ([cnx.org](http://cnx.org)) with three primary goals: to convey the interconnected nature of knowledge across disciplines, courses, and curricula; to move away from a solitary authoring, publishing, and learning process to one based on connecting people into open, global learning communities that share knowledge; and to support personalized learning (more on this below). Over the last fourteen years, Connexions has grown into one of the largest and most used OER platforms; each month millions of users access over 22000 educational "building blocks" and 1300 e-textbooks (September 2013). In addition to web and e-book outputs, a sophisticated print-on-demand system enables the production of inexpensive paper books for those who prefer or need them at a fraction of the cost of conventional publisher books. Contributions come from authors worldwide in over 40 languages, including Spanish, Chinese, Vietnamese, and Afrikaans. Siyaula ([cnx.org/lenses/siyavula](http://cnx.org/lenses/siyavula)) is developing a complete K-12 curriculum for South Africa. Vietnam is using Connexions as a faculty development tool ([voer.edu.vn](http://voer.edu.vn)). Professional societies like the IEEE are advancing their global educational outreach and inreach through content development and peer review ([ieeecnx.org](http://ieeecnx.org)).

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## **CONTACT INFORMATION**

Dr. Richard G. Baraniuk  
Victor E. Cameron Professor of Electrical and Computer Engineering  
Founder and Director, Connexions and OpenStax College  
Rice University  
Email: [richb@rice.edu](mailto:richb@rice.edu)  
Tel: 713-348-5132