



# The Emergence of Digital Course Materials in Higher Education and Their Effectiveness in Teaching and Engaging Students

Jessica Moro<sup>1</sup>

Published online: 9 July 2018

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## Abstract

About 20 million students are currently enrolled in colleges and universities across the country taking courses that, the majority of the time, require some sort of publisher-provided print and/or digital course materials.’ Historically, these have been provided by traditional publishing companies such as Pearson, Cengage, and McGraw-Hill, but with the increase in technology usage in higher education, more companies have emerged in this space such as OpenStax, a company that provides digital texts in high enrollment college courses for free. Usage of materials in college courses, particularly digital ones, are extremely useful and allow students to engage with their materials in different ways. By understanding how these materials are used in their courses, historically and currently, by both professors and students, one can start to understand the importance of them and what is needed now and for the future to ensure students are given the greatest chance to succeed in their courses.

**Keywords** Higher education · Textbooks · Course materials · eText · Online homework system

## Introduction

By using the digital course materials available to them, such as online textbooks, videos, and assessment platforms, professors can better engage their students and help them succeed in their higher education courses. “Research shows that active engagement in the learning process helps to motivate students and enhance their learning outcomes. New technologies can facilitate active engagement in learning by reducing the amount of class time where students sit passively listening to

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✉ Jessica Moro  
jn88965n@pace.edu

<sup>1</sup> Pace University, New York, NY, USA

lectures.”<sup>1</sup> The market for course materials in higher education is a four billion dollar a year industry<sup>2</sup> which at one time was dominated by a few major publishers (Pearson, Wiley, Cengage/Thomson, and McGraw-Hill) and is now seeing growth with the addition of technology companies becoming more prevalent in the market space.

Currently, there are about 20 million<sup>3</sup> students across the country enrolled at 4207 degree-granting institutions<sup>4</sup> with 1.5 million professors<sup>5</sup> teaching them. About 12 million of these students are considered traditional students, between 18 and 22 years old, “earns a high school diploma, enrolls full time immediately after finishing high school, depends on parents for financial support, and either does not work during the school year or works part time.”<sup>6</sup> The remaining 8.1 million are nontraditional students who might be older, work part-time, or delay enrollment.

Today, about 26.5% of students<sup>7</sup> are also taking advantage of the availability of more and more classes being offered online. “Technology-enabled education is one of the growth areas in the college arena, and students taking courses away from a traditional campus is part of that mix.”<sup>8</sup> Distance learning courses and online sections take advantage of the technology currently available to improve upon the correspondence model used since the 1800s, providing students in different locations the ability to learn without needing to be near a specific professor or school.<sup>9</sup>

Today’s students and professors have a variety of course materials at their disposal, from traditional publishers, such as Pearson and Cengage, and new companies, such as OpenStax, providing digital products at a reduced cost. In particular, Open Educational Resources (OER) which “are shared teaching, learning, and research resources available under legally recognized open licenses—free for people to reuse, revise, remix, and redistribute...”<sup>10</sup> have become more widely used due to the cost savings they offer. The materials used can differ based on how the course is taught, face-to-face, online only, or a mixture of both, the discipline that is being covered, and the approach the professor takes with their students (i.e. active learning, flipped classroom).

One of the main factors that can drive a decision is cost. During the 2016/2017 academic year, it is estimated that the average full-time undergraduate student spent about \$1250 on their books and supplies, regardless of the type of institution in which they were enrolled.”<sup>11</sup> So after taking all of this into account, how does someone decide what materials to use for a course?

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<sup>1</sup> Baldwin [2].

<sup>2</sup> Mickey [11].

<sup>3</sup> National Center for Education Statistics [16].

<sup>4</sup> Mickey [11].

<sup>5</sup> National Center for Education Statistics [15].

<sup>6</sup> Choy [4].

<sup>7</sup> Mickey [11].

<sup>8</sup> Ibid.

<sup>9</sup> Williamson [23].

<sup>10</sup> Edutopia [7].

<sup>11</sup> CollegeBoard [5].

## Overview of Traditional Print and Digital Course Materials

Early examples of textbooks can be traced back to fourth Century AD Rome with Aelius Donatus' *Ars Maior* and *Ars Minor* "for young students and gives, by questions and answer, elementary instruction in the eight parts of speech."<sup>12</sup> Since then, if someone was asked what kind of text they had used for their schooling, the most common answer would have been limited to printed books, manuals, and/or study guides. But, with the development of new technology and the ability for most to access it, the answer has likely changed to include some, or only, digital materials. In the late 1980s and early 1990s, use of multi-media materials was fairly new in the academic space. "According to the 1994 National Survey of Desktop Computing in Higher Education...just four percent of college courses use either multimedia or CD-ROM-based instructional materials."<sup>13</sup> The last two to three decades have seen many of these instructional materials move online to offer a variety of study tools and then transformed into learning management systems and online homework platforms that allow instructors to post their own course materials and assignments and communicate with their students, freeing them to have more time to work with students. Digital materials are at the forefront of the textbook publishing world, forcing publishers to reevaluate their offerings and come up with new options for professors to use while newer technology companies are entering the market, offering all-digital solutions at sometimes half the price.

In this section, we will explore the offerings from two traditional publishers, Pearson Education and Cengage, and one digital publisher, OpenStax.

### Main Text

When it comes to the textbook, one of the main questions that is asked, by students and professors alike is, 'Why do they cost so much?' The question they should really be asking is, 'How do you make a textbook?' Creating the 4-color, hard-bound, heavily illustrated textbooks that can run up to 1000 pages we are familiar with today is no easy feat. There are numerous decisions to be made which leads to a variety of different choices for professors to make when choosing a text.

Textbooks have also been an area that has allowed for more creative use of design and color. In fact, competition in the textbook market, along with children's books, "drove publishers to heavy use of color and illustration. At first, the competition was mainly in the amount of graphic effects used, but gradually the quality of design became the selling point."<sup>14</sup> Today, the figures and photos for textbooks, aside from the media platform, can be one of the highest line items on the budget. For example, a textbook for introductory psychology might include close to 300 photos while one for introductory biology could include well over 1000. Once all of those choices

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<sup>12</sup> The Editors of Encyclopaedia Britannica [21].

<sup>13</sup> The Campus Computing Project [20].

<sup>14</sup> Lee [9].

have been made, costs are also factored in for reviewers (subject-matter experts, proofreaders, copyeditors, market research) and design (including learning design). After all of the above has been added to a budget that also contains costs for printing the text, the number can easily go into six figures, and this is even before digital resources (like online homework platforms and eTexts) and supplements are factored in. Depending on the type of textbook (STEM, Humanities and Social Sciences, Business) costs will vary.

In addition to making texts available in printed versions, digital textbooks or eTexts (versions of the printed textbook available online) have been available for years, but are now becoming more popular and vital due to emerging competition from new companies, students access to mobile devices, and lower price points. In order to remain competitive, they must have interactive assets, questions throughout, and be available on all mobile devices. “The eText has become more interactive, user friendly, and mobile accessible...we want to offer something better in digital than in print if we are asking people to make the switch. Things like embedded video, text that fits the screen to keep it readable, and self-check quizzes with automatic feedback help make this so.”<sup>15</sup>

The Pearson and Cengage eTexts are both available in their respective online homework platforms, Mastering/MyLab and MindTap, and also through Android and iOS mobile apps. They have similar features such as the ability for students to customize by highlighting and entering notes and for instructors to share notes, links, or content with them and the ability to organize the content, as needed, to follow their syllabus. Videos are also embedded for students to access right where they need them instead of having to search for similar videos on Google or YouTube. While the OpenStax book is also online, it is only available through a browser with some embedded links and a search feature. Due to its lower price point (the digital version is free) it appears that many of the features included with the traditional publisher’s digital texts are not available. They have partnered with a number of other companies which make assets such as assessment and videos available to students and professors. Depending on what students and professors are looking for, the biggest eText asset could be the fact that it is available anywhere.

On the professor’s end, there are different options available for a main text in their course, both printed and digital. Depending on the course and level of students, the printed textbook may also be available unbound and three hole-punched. In addition, professors and departments can also customize their texts, offering a reduced amount of content and adding content from other books or their own which can also help drive down costs. If a professor were to choose a text, let’s use general biology as an example, and logged onto the publisher’s website, they would find the options in Table 1 for consideration.

After the professor has chosen which text to use, the student can choose from new versions of the print or digital versions, used, or rental options from sites such as Amazon and Chegg which could reduce the costs even further.

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<sup>15</sup> Moro [12].

**Table 1** Textbook access and pricing options

	Cengage Cengage.com	OpenStax Openstax.org	Pearson Pearsonhighered.com
Print	1. Main text (print only): \$249.95	1. Print only: \$55.00	1. Main text (print only): \$259.60 2. Loose-leaf edition: \$176.53
Digital	1. eText only: \$125.00	1. eText only: free	1. eText only: \$105.99

## Supplements (Instructor and Student)

As more professors and students move online to access their textbooks and other materials, publishers have done the same with their supplements. What was once a stack of multiple books or manuals available to aid instructors in creating their courses and help students in ensuring that they are clearly understanding the content and studying effectively has now been cut down to just two or three with an additional site, the online homework platform, available for anything else that might be needed in order to help someone with their course.

Instructors are provided with a number of supplementary materials that help save time and bring more of the text materials into the classroom. These range from instructor's manuals, test banks (suggested test questions), PowerPoints, and even JPEGs of the images and photos. As technology has progressed, from overhead projectors in the 1930s, to floppy discs and CD-ROMs, these materials have been made available in a variety of different ways. Various manuals and teaching guides may be available digitally or printed and include ideas for instructors on how this material can be used inside and outside of the classroom. PowerPoints may include just images, which professors can use on their own, or they could include content and references to the chapter, ideas for discussion, engagement questions, and images. These supplements are free to the instructor to use in their course preparation.

Student supplements are meant to help them study and ensure they understand the content. These can take the form of manuals and workbooks including outlines, key terms and study questions to use outside of class, or workbooks to use in class. For the most part, these are printed manuals organized similarly to the main text. Student supplements including study guides, workbooks, lab manuals, and solutions manuals are either sold on their own or in packages with the textbooks.

## Online Homework Platforms and Learning Management Systems

Online homework platforms and learning management systems are currently used by schools and professors around the world to support the classroom experience. These sites allow professors to communicate with their students, assess their understanding of the course content, and provide both students and professors with the materials that they need to effectively get through their courses. The increased use of these systems has had a profound impact on today's classroom and how students learn.

Learning management systems were used prior to online homework platforms to allow professors to communicate with their students outside of class, post assignments and study materials, and keep track of their grades and are still used by many colleges and universities today. The popularity of these sites have not diminished due to the emergence of online homework platforms. In fact, a homework platforms ability to integrate with a LMS can be one of its most important features. While these two types of platforms, online homework platforms and learning management systems, seem to offer similar features (gradebook, ability to provide students with their homework and extra help) there are major differences to the types of information they are able to provide. “Learning-management companies could only tell an instructor is a student had logged into his algebra course; publishers could tell if the student understood quadratic equations [8].”

In the learning management system, instructors have access to many features that will organize their classes, provide students with assessment and study materials, and house their grades. “An LMS lets you create eLearning content (lessons), organize it into courses, deliver the content...enroll students to said courses, and, finally, monitor and assess their performance (attendance, grades, etc).”<sup>16</sup>

The online homework platform, which started off as a supplement has quickly come to the forefront as an equal part of the text package and adoption decision. When asked about these materials an Acquisitions Editor for Pearson Science said that when he first entered the publishing industry a decade ago, “the book was the deciding factor and the tech piece was a nice add on that they may or may not use. Now (though the book still plays a big role) decisions on the tech piece are just as if not more important than the book decision. Customer will pick a technology and then pick from the available books that fits best.”<sup>17</sup> Cost of entry into many disciplines in the higher education market from publishers, not only includes the textbook, but a homework platform. “In recent years, the lure for publishers, faculty, and students has been adaptive programs which are seen as a means of helping students master the content and progress through the course successfully.”<sup>18</sup> These are vital systems that can provide a personalized learning experience for students. Widely used publisher-created systems include Mastering and MyLab from Pearson, Mind-Tap and WebAssign from Cengage, and Sapling from Macmillan, which has also partnered with OpenStax as one of their online homework providers. Platforms like these have been around for the last 10–15 years and are the future of the industry.

In Table 1, the sample pricing for textbooks in the general biology course were provided from 3 different publishers (Cengage, OpenStax, and Pearson), access to online homework platforms can be provided one of two ways, either packaged with the textbook or on its own (purchased online or in the bookstore). Table 2 shows the options available (again, the pricing below is from the general biology course).

Instructors and students log onto online homework platforms to access assignments, course materials, and/or track student progress. For assignments, instructors

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<sup>16</sup> TalentLMS [19].

<sup>17</sup> Moro [12].

<sup>18</sup> Mickey [11].

**Table 2** Standalone online homework platform access code costs

	Cengage MindTap	OpenStax Sapling, WebAssign	Pearson Mastering
Digital access	1. 6-Month access: \$115.00 2. 24-Month access: \$150.00	1. Sapling access: \$40 1. WebAssign single term access: \$35.95 2. WebAssign multi-term access: \$51.90	1. Mastering without eText: \$68.95 2. Mastering with eText: \$115.95

use the platform to create and deliver assignments while students complete them and also get guidance similar to what they would receive in an office hours experience. The assignment creation and delivery process for an instructor is an area that can save a professor time depending on how easy the system is to use. A difficult process here could be something that ultimately forces a professor to switch platforms. In fact, there are some companies that take this work directly out of the professors hands and will have their own employees create the courses for them based on their syllabi. Sapling, for example, offers what they call a Client Success Specialist, “Ph. D. or master’s-level subject expert- who provides collaboration, software expertise, and consulting to tailor each course to fit your instructional goals and student needs.”<sup>19</sup> As part of this, they will help professors learn the system and, in some cases, actually set up their courses for them, ensuring that the platform is doing everything it needs to. Part of this difficult and/or overwhelming assignment creation process can be reviewing the items that are available for each topic or chapter. Some systems may include hundreds of simulations, questions, tutorials, and videos that can be assigned for each chapter, not including items that instructors can create themselves. A company that can make this process more streamlined and adaptive to fit a professor’s specific needs will be one that will same time and attract more business. When students complete their assignments in an online homework platform, they are provided with instant feedback letting them know if they are correct or incorrect and, in some cases extended feedback letting them know why they were correct or incorrect and different hints to prompt a correct answer on their next try.

Course materials are also provided in online homework systems. For instructors these may include many of the supplements traditionally presented in other formats such as the test bank, instructors manual, and powerpoints. For students study materials might include additional quizzes, some graded or not, videos and tutorials, and different systems integrated into the platform to offer students other ways to access the content and engage with it. For example, systems like Mastering and Sapling have integrated classroom response systems, Learning Catalytics and iClicker respectively. These allow professors to immediately engage their students during class, check their level of understanding, and address any misconceptions as they develop.

<sup>19</sup> Macmillan Learning [10].

Gradebook analytics can be one of the most powerful features of these platforms, providing instructors with at-a-glance updates on exactly how their students are doing on any particular topics, and allowing them to drill even deeper. Some gradebooks may use color-coding to give professors a quick glimpse of how their students are doing and any areas where they might be struggling allowing them to use class time to revisit particularly difficult topics and address any misconceptions.

Finally, the eText. Each platform has a different way of offering the text, but this is one of the ways that the eText first made itself available to students. Earlier the eText and embedded assets were discussed, but some of these systems, such as MindTap, have gone a step further and integrated their eTexts along with the assessment material, making everything available to their students in the assignments, right when they need it.

With many instructors using both online homework platforms and learning management systems, the integration of the two can be vitally important, and typically falls on the publisher to perfect. The biggest advantage to this integration is single sign-on, meaning that once a student logs onto their LMS, Blackboard for example, they will also be able to access the content from their online homework platform. For instructors, this means fewer registration issues (students forgetting their access information or signing into different accounts using different usernames) and their online homework grades will transfer to their LMS gradebook, resulting in a time savings among other benefits.

## **What Digital Course Materials Are Being Used in the Classroom and What Do Professors Want**

Now that we know what types of materials are available for professors to choose from, it is important to assess which of them are being used, how effective they are in engaging their students, and if there is anything else that they are looking for. More technology devices are available today than ever before—smartphones, tablets, e-readers, laptops, and others. Because of this, students have the ability to access their course materials in a variety of different ways wherever they are, no longer requiring them to carry around a bag full of heavy textbooks. The challenge with digital materials is to ensure that students are familiar with how to use them and all the features available to help them understand the content.

### **What Devices Are Students Using?**

Today's students are vastly different than those that came just ten to 15 years before them. This has a lot to do with the products introduced by Apple and the rest of the technology industry. If you go back in time to the introduction of the iPad and Smartphone, you will see a correlation to the availability and increase in popularity of the above mentioned materials. So, what types of devices do today's students own? A recent study found that 97% of college students own a smartphone, 95%



own a laptop, and about half own a tablet, all numbers, except for tablet ownership, have increased over the last year.<sup>20</sup> With all of these devices on hand, some professors may try and ban them for class use, worrying that they will shift attention away from the learning at hand. Instead, they should be looked at as valuable teaching devices that can help students engage with content in new ways. “If students are to learn how to become independent learners and thinkers, instructors need to abandon the *in loco parentis* posture...and adopt proven student centered pedagogical approaches such as active learning that deliberately leverage and incorporate the learning tools students carry with them.”<sup>21</sup> In addition to these personal devices, college campuses also have computer labs in many of their buildings and libraries with additional computers available. Given this information, the majority of students today have access to some type of technological device that will allow them to access the digital materials needed in order to participate in their classes.

A study conducted by the Book Industry Study Group found that “the percentage of students who prefer print textbooks continues to decrease as more students explore digital products.”<sup>22</sup> Perhaps due to this and having more professors embracing digital texts, the area with the highest level of growth in higher education publishing, through this survey, can be seen with digital textbooks. “Students prefer technologies that help them solve problems, master difficult concepts, complete homework assignments, and prepare for tests.”<sup>23</sup> Recently, the National Association of College Stores completed a survey of students about their buying habits and found that 23% purchased digital materials for their courses, an increase over the previous year.<sup>24</sup> Students are increasingly reluctant to pay for high-priced content and will explore many options to procure their learning materials at the lowest possible price. However, they are quite willing to pay for learning solutions that help them to be more successful in their courses.”<sup>25</sup>

The most important thing that must be done by professors to ensure that students are effectively engaging with the content and are taking advantage of the technology is to ensure that students know what features are available for them in the eText (or introduce them to the ones that will help them understand the content) and make sure that they are interacting with them as much as possible.<sup>26</sup>

## Materials Currently Used by Professors

Inside the classroom, professors are using digital materials in many different ways, that depend on a variety of factors including how the class is offered, face-to-face, blended (an approach that combines both classroom and online learning), or fully

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<sup>20</sup> Brooks and Pomerantz [3].

<sup>21</sup> Ibid.

<sup>22</sup> Paxhia [17].

<sup>23</sup> Ibid.

<sup>24</sup> National Association of College Stores [14].

<sup>25</sup> Paxhia [17].

<sup>26</sup> Abaci et al. [1].

online. There are a number of ways that these assets can be used both outside and inside of the classroom. For example, Professor Tom McGrath at Baylor University, has “several different ways of asking students questions: online homework; my own self-assessment questions delivered through LMS; links to primary literature or interesting videos or interactives...Adding all of these has helped engage students in different directions and every time they engage with course material and work through it from different perspectives, they seem to get more enthusiastic—this is a cycle that ultimately feeds itself.”<sup>27</sup> He is able to use both the LMS and online homework platforms to deliver questions to his students in a number of formats with a wide variety of assets that allow his students to interact with the same content in a number of different ways, a method that other professors have found useful as well. Niva Tro, a chemistry professor at Westmont College in California and author of a successful franchise of Chemistry textbooks, currently uses a similar method with his face-to-face students, using a number of the assets he developed for his texts to ensure that his students understand the materials. Professor Tro assigns “interactive videos before and after class and also use[s] a classroom response system in class. These have revolutionized [his] classroom and have improved student learning.”<sup>28</sup>

In online courses, technology is especially important as it needs to successfully allow professors to engage their students, communicate with them, and make sure they understand the content. At Texas A&M an introductory microeconomics course will take advantage of everything technology has to offer, allowing thousands of students to take the course without ever having to step foot into a classroom. Professors Jon Meer and Steve Wiggins are using a variety of materials including “pre-recorded lessons, engineered an interactive video platform...homework and reading materials, and uploaded everything digitally.”<sup>29</sup> Their hope is that by preparing the course in this way, they can now focus on individual students “who’re genuinely interested in a deeper pursuit of economics,”<sup>30</sup> or having issues with the content. Offering the course in this way “marks one of the first times that a university is moving a key lecture online without offering another choice.”<sup>31</sup>

### Materials Requested by Professors

In a survey conducted of editors, marketers, and others in publishing, some of the top products that they said professors have asked them for (through conversations, reviews, and surveys) include videos on tough topics, cheaper materials, and a system to help effectively use and implement these. “Professors want to be able to easily create assignments that teach problem-solving skills mixed with instructional content during the learning process. They also want to be able to actively engage students outside of the classroom. These features need to have seamless UX [User

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<sup>27</sup> Moro [13].

<sup>28</sup> Ibid.

<sup>29</sup> Wang and Schrage [22].

<sup>30</sup> Ibid.

<sup>31</sup> Ibid.

Experience] experience similar to online shopping. The goal is to save time and mimic the office hour experience.”<sup>32</sup> Whenever asking for products, the top request professors made was for a system that was easy to use for both students and professors and for tech support to be responsive and helpful.

Educause recently released a study on how technology is used in the classroom, the trends they are seeing, and suggestions for the future. In that study, they found that in order to better integrate technology in their courses, 37% of professors want evidence that students will benefit from this and 24% want more time to redesign their courses to implement them.<sup>33</sup> Overall, the findings from this report were a bit contradictory with regards to tech usage, professors did not want to teach in an online or blended environment, but when asked about individual components that would make their course more blended (videos, LMS integration, media assets) they felt that using these would make their classes more successful. “And when faculty are not optimistic about the benefits of certain instructional technologies, they tend not to engage in the teaching modalities that use those technologies, resulting in a gap between student needs and faculty practice.”<sup>34</sup> In order to ensure that professors are using these assets and students are getting the most out of them, professors must be educated on the benefits and effectiveness of these and how they can help their students succeed.

## Conclusion

So what does this all mean for the higher education textbook industry? Given where we are, there is still work to be done to produce a product that will work in a majority of the markets, as not every market will use the same type of product since they may have different needs depending on the course. Many CEOs and companies, consultants and articles, will tell us that print is dying and it is only a matter of time before all textbooks are available digitally. Given the needs of both students and professors, this might not be coming as quickly as in the industry would have us believe. While the numbers have grown, there are still many students who feel that they learn better from printed materials. While we could see the traditional hardbound book disappearing, paperbacks and loose-leaf unbound versions may not.

In the future, the ideal product may be a digital text that allows professors flexibility and customization, assessment seamlessly built in with adaptive features and media assets for students to engage with, and a print component, similar to an outline or study guide to help ensure students understand the content. There also must be the ability to offer some version of the content in a print format that would allow those who want a print version access to the same content offered in the digital format, although they would still need access to the digital format in order to complete

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<sup>32</sup> Moro [12].

<sup>33</sup> EDUCAUSE Review [6].

<sup>34</sup> Pomerantz and Brooks [18].

assessment items. Regardless of what the product looks like, price will also be a large part of the decision as well.

Examples of products being created by Cengage, OpenStax, and Pearson show the development and release of materials that are moving in the right direction, engaging students in different ways and taking advantage of what technology has to offer by providing an improved experience over what a print text alone can. These are also providing instructors with improved products, giving them a deeper understanding of what is going on with their students learning outside of the classroom so that they can better address their needs inside of it.

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