

THE IMPACT OF OPENCOURSEWARE ON PAID ENROLLMENT
IN DISTANCE LEARNING COURSES

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ABSTRACT

The Impact of OpenCourseWare on Paid Enrollment in Distance Learning Courses

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Since MIT launched the first OpenCourseWare (OCW) initiative in 2002, responses from the academic community have ranged from exuberance to angst. Some institutions have been reluctant to adopt a program of open publishing because of concerns about long-term funding and possible adverse effects on paid enrollment. Money is an issue, forcing some organizations that initially created OCW programs to furlough them due to funding challenges.

This study examined the cost of converting online distance learning courses to OCW, the impact of opening these courses on paid enrollments, and the long-term sustainability of OCW through the generation of new paid enrollments. As part of this study, Brigham Young University's Independent Study Program (BYU IS) converted three university and three high school courses to OCW. BYU IS provided an option for OCW users to pay regular tuition and enroll in the online course for credit.

The average ongoing cost to convert BYU IS courses to OCW was \$284.12 per university course and \$1,172.71 per high school course. The six opened courses generated 13,795 visits and 445 total paid enrollments in four months. The profit margin on the paid enrollments OCW generated was calculated to be 3.81% for open publishing to be financially self-sustaining at BYU Independent Study.

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Finally, I would like to thank my wife and children, who love me, believe in me, support me, and sacrifice for me. They continue to inspire me every day.

Most importantly, I would like to express gratitude to my Heavenly Father for blessing my life with so many good people and for all the good and virtuous things in my life. I hope this study does a little good in the world to glorify Him.

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Chapter 1: Introduction

For centuries, universities have been repositories of human knowledge and the primary laboratories for intellectual advancement. At the same time, access to universities has been reserved for the privileged few who could afford to attend. While higher education has become more accessible in recent decades, the opportunity to attend a university is still beyond the reach of many people in the developed world and most people in the developing world.

OpenCourseWare

In October 2002, the Massachusetts Institute of Technology (MIT), one of the most prestigious universities in the world, launched the MIT OpenCourseWare Initiative, effectively tore down the walls that kept the masses from enjoying the knowledge and instruction available to its students. OpenCourseWare (OCW) is founded on the idea that human knowledge is the shared property of all members of society. Institutions that contribute to OpenCourseWare projects grant anyone free access to their course materials. Since the materials are published under an open license, others do not need to request permission to reuse them. Since MIT launched its OCW project in 2002, it has made materials from over 1,900 of its undergraduate and graduate-level courses freely available (<http://ocw.mit.edu/>). MIT's OCW Evaluation Report states that users include Self Learners (46.5%), Students (32.0%), Educators (16.4%), and Others (5.2%) (MIT OpenCourseWare, 2006).

Since then, the OCW movement has reached far beyond MIT. Over 200 institutions around the world have joined to form the OCW Consortium, openly publishing over 8,000 courses in a variety of languages. These institutions share a common commitment to increasing access to education, improving the quality of education, and empowering both well-served and

underserved populations through the power of open learning (OpenCourseWare Consortium, n.d.).

Distance Learning at BYU

Brigham Young University (BYU) offers distance learning courses through its Independent Study program. Part of BYU Independent Study's (BYU IS) mission is to create access to educational opportunities by offering courses to "anyone, anytime, anywhere." BYU IS currently offers 591 online courses (218 university, 213 high school, and 80 personal enrichment) and 503 paper-based correspondence courses (251 university, 211 high school, and 41 personal enrichment courses). BYU IS had 165,026 total course enrollments in 2008 (22,762 university; 118,859 high school; 1,599 personal enrichment; and 21,806 free personal enrichment).

BYU IS operates on an open admission and open enrollment model: anyone may take a course through BYU IS without being formally admitted to the university. Participants may enroll in any course at any time and have up to one year to complete each course. Students work independently and at their own pace. All students are required to take final exams, under the supervision of a proctor, and they must pass the exams to pass the course. The BYU IS model focuses on minimizing costs for students by controlling content development costs, using technology to manage support expenses, building courses that minimize the use of costly textbooks (where possible), and avoiding the use of copyrighted materials.

OpenCourseWare and BYU Independent Study

Despite its history of creating accessible and affordable distance learning courses, BYU IS has yet to engage in a program of open sharing like OpenCourseWare. Open publishing programs at other universities have been primarily grant-funded, and long-term sustainability has

been a significant problem these programs. BYU IS, on the other hand, is supported by the tuition revenue its courses generate. It does not receive financial support from the university, from the LDS Church, from grants, or from any other external sources.

To avoid unanticipated negative impacts to the ongoing operations of the BYU IS program, its administrators must make changes to its business model carefully, and with clearly defined strategies. Additionally, the organizational culture at BYU encourages launching programs only after clearly defining strategies and resources to ensure their long-term sustainability and success. The closing of Utah State University's OCW program due to funding issues (Parry, 2009) illustrates the fact that financial challenges surround the viability of open publishing programs. Before an OCW program within BYU IS will be possible, questions about cost, impact on paid enrollment, and financial sustainability need to be addressed.

The intent of this study was to empirically address some of the questions surrounding BYU IS's possible participation in OCW. The study focused on the following three questions:

1. How much does it cost to open an existing BYU IS course?

Understanding the costs associated with opening BYU IS courses is essential to building a model for financial sustainability. Costs include factors such as the labor to convert courses to an OCW format, scrubbing of content to remove copyrighted material, using or buying necessary hardware and software, and providing other supplies.

2. How does opening a BYU IS course affect paid enrollments in the course?

Tuition revenue from paying students supports BYU IS. If fewer people pay to enroll because they choose to use only the free content from the OCW course, then the true cost of opening a BYU IS course would be higher than simply the cost of converting or opening the course. Alternatively, if offering the OCW course increases the number of students who choose

to pay to enroll in the regular course for credit, then OCW could generate new tuition revenue to offset the conversion cost.

3. If the impact on paid enrollments is positive, is it enough to sustain an ongoing open publishing initiative at BYU IS?

If offering OCW courses attracts new paid enrollments, the profit from those additional enrollments could offset the expense of offering OCW courses, making the program self-sustainable.

Discovering the answers to these three questions is critical for BYU to determine how and to what extent Independent Study can feasibly participate in a program of open publishing. Answers to these questions may also be useful for other institutions considering an OCW program.

Chapter 2: Literature Review

Precious little has been published on the sustainability or costs of OCW initiatives. This section summarizes the available literature dealing with OCW sustainability and the costs of developing OCW courses, as well as data extrapolated from publically available sources and information from personal communications with representatives of OCW organizations.

The Cost of OpenCourseWare Courses

It would be ideal to base this study on cost data from distance learning programs similar to BYU IS. However, while there are over 200 member institutions in the OCW Consortium, very few distance learning programs currently participate. Perhaps this is due in part to fear or uncertainty about the effect an OCW program will have on paid enrollment in distance learning courses.

While there is no published cost data from distance learning institutions, some traditional OCW projects have made their cost data available. The MIT OCW Evaluation Findings report (MIT OpenCourseWare, 2006) states MIT OCW's cost to open a course as ranging from \$10,000–\$15,000 per non-video-based course to \$30,000 per video-based course.

Utah State University (USU) reported that their cost to open one course was approximately \$5,000 (Wiley, 2007). USU's expenses came primarily from the labor costs of the personnel working on USU's open publishing initiative. USU's open publishing team consisted of a full-time Director, two half-time graduate students, and three half-time undergraduate students. USU also opened some courses with no direct cost by having students and graduate students publish courses as class projects.

One challenge in discussing the costs of opening courses is the different ways that institutions define a *course*. Both MIT and USU define an OCW *course* as a publication of those materials used to teach the course on campus. The Open University of the Netherlands (OUNL), a distance learning institution, defines an OCW course as twenty-five study hours of content. Their open publishing initiative was funded by grants of approximately €660,000 (\$858,000), equating to an average of \$34,320 per OCW course published (R. Schuwer, personal communication, December 18, 2008).

Like OUNL, the OpenLearn Initiative of the Open University in the United Kingdom (OUUK), another distance learning institution, does not publish complete courses. Instead, they publish *samples* of courses to let OCW users see a portion of a course. One of the OUUK's goals in providing course samples is to convert OCW users into paying students. Each course sample has a button that students can click to "enroll now" to complete and earn credit for the full course. OUUK has opened course samples for approximately 40% of the course catalog, with the average sample consisting of approximately 11 hours of instruction. The OUUK's average cost for opening one study hour of legacy material is about £350 (\$535), or \$5,885 for the average 11-hour sample (A. Lane, personal communication, December 5, 2008).

For this BYU IS study, *course* is defined as those materials, less the graded course assessments, used to teach the Independent Study version of a course. BYU IS's approach to producing courses offers some cost advantages when converting courses to an OCW format. First, BYU IS limits the number of expensive textbooks used in its courses. In fact, many of the high school courses BYU IS offers do not require a textbook at all. Instead, BYU IS makes a

significant investment during the development process to create content-complete and media-rich courses. Accordingly, while most OCW programs offer partial courses, many BYU IS courses are complete and comprehensive. The courses chosen for the pilot fall into this category.

Second, most OCW courses are converted from traditional face-to-face courses. The process of converting those courses for OCW often involves digitizing paper-based materials (originally developed for the classroom) into a format appropriate for online delivery. In contrast, BYU IS courses are designed from the beginning for Internet delivery and do not need digitizing to create an OCW offering. However, the courses do require some modification (e.g., removing graded assessments, revising instructions, and adding the Creative Commons license).

Third, BYU IS benefits from its minimal use of copyrighted materials, as well as from favorable contractual terms with faculty which reserve intellectual property rights for the institution. This prevents BYU IS from incurring as many *copyright scrubbing* costs as many other OCW projects. Copyright scrubbing includes identifying copyrighted content in a course, identifying the rights holder, negotiating for rights to use the material, and paying any applicable license fees. This scrubbing cost, which is almost non-existent for BYU IS in converting its courses to OCW format, can be one of the most expensive aspects of converting courses to OCW. These unique aspects of the BYU IS courses make it possible to convert most courses to OCW at a significantly lower per-course cost.

For the purposes of this study USU's course conversion costs were used as a baseline for estimating how much it would cost to convert BYU IS courses to OCW. USU was considered the best example for course conversion costs because their definition of a course and the content

they converted to OCW was similar to BYU IS's. USU's average cost to open a course was \$5,000 (Wiley, 2007). Because of the content-complete nature of the selected BYU IS courses and the program's limited use of copyrighted materials, it was estimated that courses could be converted at a savings of 20%-40% less than USU's per-course cost, or approximately \$3,000 to open each BYU IS course. When making these estimates, the lack of published information on course conversion costs for existing OCW programs spoke to the need for carefully and empirically collected data on the direct costs of opening courses.

The Impact of Opening an OCW Course on Paid Enrollments in that Course

The OpenLearn Initiative at Open University in the United Kingdom (OUUK) was the best comparable program to use when considering the impact opening courses could have on BYU IS. The OUUK has approximately 200,000 course enrollments and 130,000 students each year, similar in scale to BYU IS. In two years of offering course samples, 7,800 enrollments have come from people who used the "enroll now" button in the OUUK's course samples to convert to a fully paid enrollment (A. Lane, personal communication, December 5, 2008). This means that approximately 1.95% of the OUUK's enrollment over the past two years has come through conversions from free OCW users into paid course enrollments. Approximately 33% of those conversions were people who were new to the OUUK system, meaning that approximately 0.64% of OUUK's entire enrollment for a given year were new users that converted to paid enrollment from a free course sample. That equates to an average of approximately 1,280 new paying students converted through course samples each year.

While the OUUK provided data on the number of enrollments that came from people using “enroll now” button to convert to paid enrollments, there was no data on the overall effect of OCW on paid enrollments. In other words, there was data about the positive impacts of OCW on OUUK (conversions using the enroll button), but no data on the possible negative effects—and therefore the net effect—that offering OCW had on paid enrollment.

Similarly, the Open University of the Netherlands reported that 18% of OCW users were “inspired to purchase an academic course” based on their interactions with OUNL OCW (Eshuis, 2009). Again, while this data was encouraging, it did not offer much insight into the net effect OCW publishing had on paid enrollments.

The University of California-Irvine (UCI) launched an OCW offering in November 2006 with a “click to enroll” feature. They report that their OCW site has consistently generated more site traffic and more sales leads than any other form of advertising (K. Tam, personal communication, June 4, 2009).

No other data on the impact of OCW on paid enrollments was available at the time of this study. This dearth of data further underscores the importance of the current study.

The Sustainability of an Open Publishing Initiative

Many question whether a project whose primary goal is giving things away can be meaningfully self-sustaining. This study focuses on the issue from a purely financial standpoint. However, consideration should also be given to how OCW aligns with and supports the mission and strategy of an institution or organization. By empirically examining the impact of OCW on paid enrollment, BYU IS will be able to weigh the financial sustainability of OCW as a part of a

larger strategic discussion of other factors such as organizational mission, community outreach, marketing, retention, student satisfaction, learning achievement, and so forth.

From a financial perspective, there do not appear to be any organizations currently running large scale, self-sustaining open publishing initiatives. In fact, some projects have already stopped active development due to lack of ongoing funding. For example, when their grants ended, the Foothill De Anza Community College District's SOFIA project (<http://sofia.fhda.edu/>) stopped producing new courses. Additionally, the Utah State University OCW initiative's legislative funding has ended, and there are no longer any personnel at USU working on OCW courses (<http://ocw.usu.edu/>).

Even MIT OCW, the leader of the OCW movement, must raise approximately \$4,000,000 each year to sustain operations (approximately \$2,000,000 in donations and \$2,000,000 in budgetary support from the university). Outside of donations and budgetary support from the university, another external funding source for MIT is the revenue earned from Amazon.com as OCW courses refer users to Amazon to buy the textbooks they need to completely engage with their open courses. In speaking about the importance of user contributions, MIT OCW Director Cecilia d'Oliveira (2009) wrote that MIT OCW "must continue to demonstrate that our user community can be an important piece of our ongoing funding model."

Sustainability Models for OpenCourseWare. Downes (2007) wrote about various sustainability models for OCW. Those eight models are summarized below:

1. Endowment Model – Initial funding from grants, contributions, and other sources is invested and the interest is used to fund ongoing project costs. Many universities fund a portion of their annual budgets through their endowment.
2. Membership Model – Members pay a one-time or reoccurring membership fee to fund project costs. The Sakai project is an example of the membership model. Members pay an annual fee in exchange for the right to influence the product roadmap and for access to code releases and documentation (Sakai, 2005)
3. Donations Model – Donations from users, foundations, and other sources fund ongoing projects. Wikipedia is one of the best-known examples of this model (Foote, 2005), raising six million dollars in 2008 through donations (Metz, 2008).
4. Conversion Model – Providers give users of a free product the opportunity to pay for additional access or services. OCW initiatives at OUUK, OUNL, and UCI use the conversion model. This study also uses this model, as each OCW course will include a path for users to enroll in the credit version of the course and pay the regular tuition for course credit.
5. Contributor-Pay Model – The people contributing the freely available content actually pay to contribute. While it seems counterintuitive that people would actually pay to give things away, some foundations and universities require that publications coming from the institution be openly published. The content contributor pays the publisher a fee to offer the material, which replaces the revenue the publisher would normally generate through subscription sales and licensing fees.

6. Sponsorship Model – Sponsoring individuals or organizations fund projects in exchange for recognition or advertising. Freely available public radio and television programs are funded through the sponsorship model, and advertisers receive commercial time in exchange for payment. The banner advertisements on many websites and the product logos on athletes' jerseys or race cars are also examples of sponsorship funding.
7. Institutional Model – The institution funds the project as part of its mission and annual budget. Approximately half of MIT OCW's budget is institutionally funded. However, institutional funding typically comes from one of the other funding models.
8. Government Model – Government funds and grants support projects. As USU's recent furloughing of its government funded OCW project illustrated, however, , funding under the government model can be difficult to predict and sustain.

Downes (2007) also discusses the importance of partnerships and exchanges, such as the International Fellowship Programme offered by the OUUK (Open University, n.d.). These instances often involve the exchange of non-financial contributions such as content, technology transfer, expertise, and ideas that support social movements such as OCW.

Supporting Models for OCW Programs. OpenCourseWare has become a social movement. As is often the case with social movements, OCW relies in part on the volunteer efforts of passionately committed individuals whose efforts are coordinated and managed in varying degrees by a governing body or institution. Wiley (2007) discussed the different OCW funding and support approaches of MIT, USU, and Rice University to illustrate how institutions

differ in terms of centralization, coordination, and use of volunteer support in managing OpenCourseWare.

1. MIT – MIT’s funding model for OCW is highly centralized, very coordinated, and relies on little volunteer support. MIT supports its OCW initiative as part of its institutional mission, funding 50% of its OCW budget through the university’s annual budget and deploying institutional resources to help raise the other 50% through donor contributions. Full-time university personnel centrally coordinate support of MIT’s OCW initiative, relying on little volunteer support for ongoing operations.
2. USU – USU’s OCW project was centrally managed but externally funded and volunteer supported. Faculty members and students volunteered to support the full and part-time USU staff assigned to support the university’s OCW projects.
3. Rice University – Rice’s OCW project is called Connexions. Connexions is decentralized, user coordinated, and almost entirely dependent on volunteer support. Connexions is managed by a global open-source community that contributes content and manages the Connexions software platform; its user support is similar to the open-source community behind Linux and OpenOffice.

As noted, this study uses the conversion model for BYU IS’s OCW courses. The study was centrally supported, coordinated by full-time BYU personnel, did not rely on volunteer support. In addition, users have the opportunity to convert from the OCW version of a course to the credit version by paying the regular tuition and completing the course assessments.

Creative Commons Licenses and OpenCourseWare

Practically all OCW content is published under a copyright license called Creative Commons. Creative Commons (CC) licenses designate content as openly published, and even make it possible for Internet search engines, including Google and Yahoo, to discover and specifically catalog OCW content. OCW publishers can publish content under different versions of the CC license, thereby granting various permissions to OCW users. The CC licenses can include four different types of conditions:

1. *Attribution* – The attribution condition of the CC license stipulates whether users of OCW content are required to credit the original author of the work. The attribution condition is currently included in all CC licenses (but was optional in an earlier version).
2. *Share Alike* – The Share Alike (SA) condition of the CC license stipulates whether OCW users are required to openly license derivative works developed using OCW content. In other words, by using a license including the SA condition, content publishers grant others the right to use and modify their openly published content, so long as any subsequent versions of that content are published under exactly the same CC license.
3. *Noncommercial* – The Noncommercial (NC) condition of the CC license stipulates whether or not the openly licensed content may be used for commercial purposes.
4. *No Derivative Works* – The No Derivative Works (ND) condition of the CC license stipulates whether the openly licensed content may be modified or included in another work.

These options can be combined to create six forms of the CC license. Here is a summary of each of those six licenses, quoted directly from the Creative Commons website (Creative Commons, 2009):

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The courses opened for this study are licensed using the Attribution Non-Commercial Share Alike (BY-NC-SA) license, indicating that users should cite BYU as the original source, that they can use content only for non-commercial purposes, and that content users must openly license any derivative works. BY-NC-SA is the license assigned to most OCW content worldwide.

Chapter 3: Method

For this study, BYU IS converted three university courses and three high school courses to OpenCourseWare offerings. The cost of opening each course was carefully tracked. The enrollment trend (after opening) for each opened course was compared with enrollment trends for three control courses and with overall enrollment for university and high school courses. Using cost and enrollment data, an analysis of the financial self-sustainability of opening BYU IS courses was conducted. This chapter describes the course selection process, the data collection process, and the analysis methods the study used to address each of the three research questions:

1. How much does it cost to open an existing BYU IS course?
2. What is the impact of opening a BYU IS course on paid enrollments in the course?
3. If the impact on paid enrollments is positive, is it enough to sustain an ongoing open publishing initiative within BYU IS?

Selecting Courses for the Study

Speculation at any institution about the effect of OCW on paid enrollment creates both unfounded exuberance about potential benefits and fearful hesitation about potential losses. Both the exuberance and fear were empirically unsupported given that, prior to this study, there no one had published any empirical data on the topic. In the absence of sound data, BYU administrators acted with appropriate caution in exploring the idea of openly publishing BYU IS courses.

There are many potential risks associated with opening BYU IS courses, the most serious of which is that doing so could negatively impact paid enrollment and, therefore, the revenue that

sustains the BYU IS program. Given the risks and lack of empirical data, the BYU administration expected BYU IS to proceed with caution but agreed to support this project as a limited pilot. To minimize the potentially negative financial impact on BYU IS, the scope of the pilot was restricted, as well as limiting the initial to a period of four months, at which time it was to be reevaluated. Limiting the scope of the study was essential in receiving authorization to proceed.

Consistent with the University administration's guidelines for the pilot, courses were chosen (as much as possible) based on the following criteria:

1. The courses should have at least six months of enrollment history.
2. There must have been at least one other BYU IS course with a comparable enrollment pattern, and at least six months of enrollment history, as a control.
3. Selected courses should have at least 100 enrollments per year to provide sufficient data for the study. (The study could not strictly follow this criterion, as discussed in chapter 5.)
4. The courses should represent a wide range of subject areas.
5. The pilot would include only courses for which there was support from the faculty for the project. Although BYU owns the intellectual property (IP) rights to course content, this decision was made as an alternative to invoking BYU's IP rights.
6. The courses should represent the norm among BYU IS courses in terms of quality, use of media, and inclusion of copyrighted materials.

Following those criteria, the following university courses were chosen for the study:

1. Theater Media Arts 150 (TMA 150) – Public Speaking
2. Business Management 418 (BUSM 418) – Personal Finance
3. School of Family Life 110 (SFL 110) – Cooking in the Home

The following high school courses were also selected for the study:

1. Government 45 (GOVT 45) – United States and Citizenship
2. Geography 41 (GEOG 41) – World Geography
3. Earth 41 (EARTH 41) – Earth Science, Part 1

During the process of selecting courses, it became clear that a choice had to be made between selecting courses for which the faculty were supportive and courses that had at least 100 enrollments each year. Many faculty members were concerned about the potential negative impact on high-enrolling courses. Ultimately, the support of the faculty was deemed critical and courses with lower enrollments and stronger support from the faculty were selected for the study.

Tracking the Cost to Open an Existing BYU IS Course

The BYU IS cost tracking system was used to determine how much it cost to open each course. BYU IS employees who worked on converting courses for this study billed their time using that system, and their reported hours and actual salaries were used to determine the costs of converting each course to the OCW format. Existing technical infrastructure (e.g., servers, software, and office space) was used and the costs for additional storage and bandwidth were negligible.

Measuring the Impact of Opening a BYU IS Course on Paid Enrollments in the Course

The study employed an interrupted time-series (ITS) quasi-experimental design using equivalent, no-treatment control groups (Shadish, Cook, and Campbell, 2002) to determine whether or not the pattern of enrollment in OCW courses changed after they were opened. The open publication of courses is the treatment event that serves as the interruption in the ITS design. Additionally, three equivalent non-treatment control courses were selected for every course opened. Control courses were selected by calculating enrollment correlations between each course to be opened and all other BYU IS courses in the category (either university or high school) over the twelve-month period leading up to the treatment. The three most closely correlated courses were selected as controls for the courses opened for the study.

BYU IS has two peak enrollment seasons. For high school courses, that peak occurs in May and June of each year, while for university courses the peak occurs in July and August. This study ran from the first of May until the end of August, to capture both of the peak-enrollment periods. A four-month period following the interruption provided four data points for each OCW course and each equivalent no-treatment control course, the data based on one-month increments to plot enrollments trends (Shadish, Cook, and Campbell, 2002). Ideally, the data collection period would have been longer, but that was not possible given the limited scope of the pilot approved for this study. However, all of the mechanisms this study used to capture data have been left in place and continue to function to provide additional data for follow-on research (see chapter 5).

Enrollment data for each course and its three control courses were analyzed four months after the courses were opened. First, comparisons were made between the slope of the post-interruption enrollment trend lines for the opened course, the three control courses, and overall enrollment trends. The actual overall enrollment numbers were divided by 100 to fit the scale of the graphs (1000 enrollments scaled to 10 enrollments) Due to the limited amount of data available, no statistical analyses of the differences in the slopes of trend lines was calculated.

Next, enrollments in each OCW course, its three control courses, and all courses in a category (university or high school) were compared across paired months in 2008 and 2009 (e.g., comparing May 2009 enrollments with May 2008 enrollments). In the ITS design, the slope of the trend line indicates whether enrollments are trending up or down relative to prior months and allows a visual comparison of that trend line with the trend line of the controls. Comparing enrollments using paired months (May 2008 versus May 2009) provides some indication of change to the Y-intercept of the enrollment trend line. In other words, the trend lines show where enrollments are headed, while the paired months' data show the trends' origins. If a treatment course enrolled ten people per month in 2008 and a hundred people per month in 2009 (after the treatment), it would still have an improved enrollment despite a slightly negative slope in its trend line. It should be noted that recent economic conditions, changes in BYU IS's partnerships with large schools, and other external factors can have major effects on both individual course and overall enrollments from one year to the next.

In addition to the data used for the interrupted time-series and paired-months data, browser cookies and Google Analytics were used to track (1) people who visited an OCW course

but did not pay to enroll in a course, (2) people who visited an OCW course and later registered via the regular online registration process (instead of using the “click to register” button inside an OCW course), and (3) people who visited an OCW course and registered to earn credit in the course by using the “click to register” button inside an OCW course.

Advertising BYU Independent Study’s OCW Courses

Once the courses were opened, it was necessary to inform potential users. At the outset, the intent was to use the typical OCW methods of notifying institutions when a new course is opened. The original advertising plan included the following approaches:

1. BYU IS would join the OCW Consortium and create links from the consortium’s website to its opened courses.
2. Courses would be made searchable and discoverable using RSS feeds from the OCW Finder.
3. A link to the OCW courses would be added to the BYU IS homepage.
4. Links to the OCW courses would be added to the BYU IS course catalog.
5. The OCW courses might be advertised on the BYU homepage (<http://www.byu.edu>).

However, doing so would require several approvals and might not be practical or possible. About half of the OCW schools sampled had a link from their institutional homepages to their OCW courses. This method of advertising would be treated as ideal, but not required.

In the end, due to the sensitive and risky nature of the study, decisions outside of the control of the study limited the advertising conducted during the OCW pilot. Specifically, items 1 and 5 did not occur.

Sustaining a BYU Independent Study OpenCourseWare Program

Sustainability for OpenCourseWare means that the cost of opening a course must be less than the incremental profit per enrollment multiplied times the number of new enrollments attributable to the OCW courses:

$$(\text{Cost to open}) < (\text{Profit per enrollment}) \times (\text{New attributable enrollments})$$

Using cost and enrollment data gathered to answer the first two research questions, an analysis was performed to make an initial estimate of the financial sustainability of a long-term open publishing initiative within BYU IS.

Chapter 4: Results

The intent of this study was to address three research questions:

1. How much does it cost to open an existing BYU IS course?
2. What is the impact of opening a BYU IS course on paid enrollments in the course?
3. If the impact on paid enrollments is positive, is it enough to sustain an ongoing open publishing initiative within BYU IS?

To address these questions, six BYU IS courses were converted to OCW as part of a limited pilot study. Data on course conversion costs and enrollment numbers were collected over the period of the study. The study ran for four months. While it was understood that four months would not provide enough data to draw final conclusions about statistically significant differences in enrollment, this period was deemed sufficient to provide enough data to make inferences about the practical impact of opening the six courses and to inform decisions about the possible continuation of the pilot.

While it would have been beneficial to the study to select courses randomly, or even to select only those courses with desirable characteristics, such as high enrollment numbers, it became apparent early in the pilot that the study would have to use whatever courses faculty members, department chairs, and academic deans were willing to support.

Some faculty members were familiar with open courseware, and most were supportive of the goals of OCW once the goals were explained, but many instructors did not feel comfortable openly publishing their courses under the OCW model and expressed concerns that opening courses would have a negative impact on paid enrollments or create additional work for them.

Eventually six faculty members (with support from their department chairs and deans for university courses) volunteered their courses for the pilot given the following conditions:

1. BYU IS instructional designers and staff do all of the work to convert the courses to the OCW format.
2. The faculty members would not be required to grade work from, support, or communicate with OCW students (as is standard with OCW courses).
3. BYU IS would remove faculty members' contact information from the courses to avoid time-consuming calls and emails from OCW students.

The general feelings of concern about the potential impact of opening courses on paid enrollments that stakeholders expressed during the course-recruitment process underlined the need for this study. Again, BYU owns the rights to the course content and could have legally opened the courses without approval from faculty members. However, because of the potentially significant and long-term negative consequences of doing so, the decision was made to open courses only when the faculty fully supported doing so. The results of this study will inform a continuing dialogue about the benefits, expenses, value, and risks of a program of OpenCourseWare at BYU. The remainder of this chapter presents an analysis of the data gathered after opening the six courses.

The Cost of Converting Courses to OCW

Converting a course to the OCW format typically includes three types of expense:

1. Infrastructure such as hardware, software, office space, and supplies.
2. Royalties and license fees for the use of copyrighted materials in the OCW course.

3. Labor costs, including converting the material to a digital format, removing graded assessments, and copyright scrubbing the content to remove or replace copyrighted materials.

Hardware, software, materials, and supplies used to open courses. The six courses that were converted to OCW had already been developed for tuition-paying BYU IS students. The OCW sections reused that previously developed content and were delivered on existing hardware and software infrastructure. The conversion process did not require any purchase of special supplies or materials. The total cost of hardware, software, office space, and supplies for the study was therefore negligible because the study occurred within BYU IS's established infrastructure.

It is important to note that while these costs were negligible in the context of this pilot study, if BYU IS converts many more of its 591 online courses, the required computer storage capacity, software, office space, and computer hardware could increase and add to the cost.

Royalties and license fees from opening courses. No copyright or licensing fees were paid as part of the OCW publication process. As noted, BYU IS avoids the use of copyrighted materials whenever possible. Additionally, the BYU IS compensation model reserves intellectual property rights to the institution, meaning that there were no royalty expenses for content authors for use of the material in the OCW courses. In the few cases where copyrighted content was present in the selected courses, it was simply removed or masked during the conversion process. OCW users should be able to work through the courses even without the removed content, though ideally it would be replaced or licensed for use.

Labor expense of opening courses. The primary expense of opening the six BYU IS courses was developing the software tools necessary to convert the courses from their existing format into one appropriate for OCW publication. The BYU IS courses were originally developed and stored using XML, a presentation-independent format that allows content to be automatically converted into multiple formats using software-based transforms. The first step in converting the BYU IS courses was to develop a new XML transform that removed all graded assessments, applied the Creative Commons license to the course pages, and reformatted the content for delivery as OCW. Because BYU IS has historically used different approaches in the development of the university and high school courses, the two types of courses required their own XML transform.

The transforms had to be developed in the context of an actual course conversion. The expense of developing each transform was incurred, and therefore billed to, the first university-level course (TMA 150) and the first high-school course (GOVT 45) respectively. Consequently, the cost to open the first of each course type was much higher than the cost for the subsequent courses; thus, the cost to open the first of each course type is not representative of the anticipated cost of opening future courses. The first university course cost \$3,485.07 to open, while the average cost to open the second and third university courses was \$284.12. Likewise, the first high school course cost \$5,204.34 to open, and the average cost to open the second and third courses was \$1,172.71. The original development of the high school courses had taken a slightly different approach, so it was more labor intensive to convert them. The transforms were reused on the second and third university and high school courses with only minor modifications. Those

transforms are now available for use with little or no additional modification should BYU IS choose to open more courses. The costs of opening the second and third courses in each category are representative of the likely cost should BYU choose to open more BYU IS courses.

As noted, the labor costs of opening the courses were tracked using BYU IS’s project billing system, in which anyone who worked on the conversion projects billed their time to the courses they worked on. A project manager ensured that workers billed their time each week. The system used each person’s actual wage and the number of hours they billed to calculate the labor expense of opening each course. Labor costs included (a) the development of the transforms, (b) the content conversion process, (c) course review, (d) copyright review, (e) administrative and planning, and (f) any other labor used in the conversion process.

Tables 1 and 2 summarize the total labor costs for opening each course. Based on those data points, should BYU IS choose to open additional university courses, the estimated cost would be approximately \$284.00 per course. It is unlikely that modifications to the university transform could further reduce the cost.

Table 1
University Cost

<i>Cost to Convert University Courses</i>	
<i>Course</i>	<i>Cost to Convert</i>
TMA 150	\$3,485.07
BUS M418	\$320.09
SFL 110	\$248.15

Table 2
High School Cost

<i>Cost to Convert High School Courses</i>	
Course	Cost to Convert
GOVT 45	\$5,204.34
EARTH 41	\$1,203.78
GEOG 41	\$1,141.64

Should BYU IS choose to open additional high school courses, the estimated cost would be approximately \$1,173.00 per course. However, modifying the high school course development and conversion processes to more closely resemble the university course processes could further reduce the cost of opening additional high school courses. Completing the OCW course conversions in the context of the regular course revision cycle, or during scheduled course updates, could realize further efficiencies (and lower costs) for both the university and high school courses.

The Impact of OCW on Paid Enrollment in BYU IS Courses

One of the central concerns of this study is the impact of OCW on paid enrollments. Pre-study predictions ranged from the cautiously negative to the exuberantly positive. (Course-by-course results are presented below.) A common concern was that opening courses would have a negative impact on paid enrollments, because customers could access content for free and would therefore not pay to enroll. Others saw OCW as having a potentially positive effect on enrollment, as people were more likely to enroll after previewing course content before they

made a purchasing decision—much like Amazon.com’s “Look Inside!” feature. Another potential positive effect on paid enrollment was that OCW users drawn to the OCW course might pay to convert to a regular BYU IS course (similar to the OUUK, OUNL, and UC Irvine experiences).

Given the short duration of the pilot study, a statistically significant measure of the impact of OCW on paid enrollment was not possible. Knowing this from the start, the study focused on looking at the practical significance of opening courses so that BYU (and others who may be considering a program of open publishing) might better understand the implications of doing so.

The study used an interrupted time series (ITS) approach to examine the impact of opening courses on paid enrollment in those courses. Enrollments in BYU IS courses vary widely from month to month through the year because of factors such as summer school programs, graduation deadlines, initiatives at partner schools, and so forth. Therefore, simply comparing enrollment numbers before and after the treatment would be inappropriate. Instead, post-interruption enrollment trends for opened courses were compared with control courses. Data in the following figures illustrate comparisons between enrollment trends in (1) the opened course and the control courses, and (2) the opened course and overall enrollment trends (university and high school respectively). From a practical standpoint, major differences in the trend lines for the opened courses as compared to the control courses, and particularly the overall enrollment trend lines, would suggest an impact from opening the courses.

University Course #1: Theater and Media Arts 150 (TMA 150) – Public Speaking.

Enrollment in TMA 150 most closely correlated with enrollment in the courses listed in Table 3.

Table 3
Enrollment Correlations with TMA 150

Course	Correlation
SFL 100 - Strengthening Marriage and Family	0.79
ACC 200 - Principles of Accounting	0.75
PHSCS 123 - Principles of Physics 2	0.71

Figures 1, 2, and 3 illustrate enrollment trends in TMA 150 compared with the three control courses, and with overall university course enrollment trends.

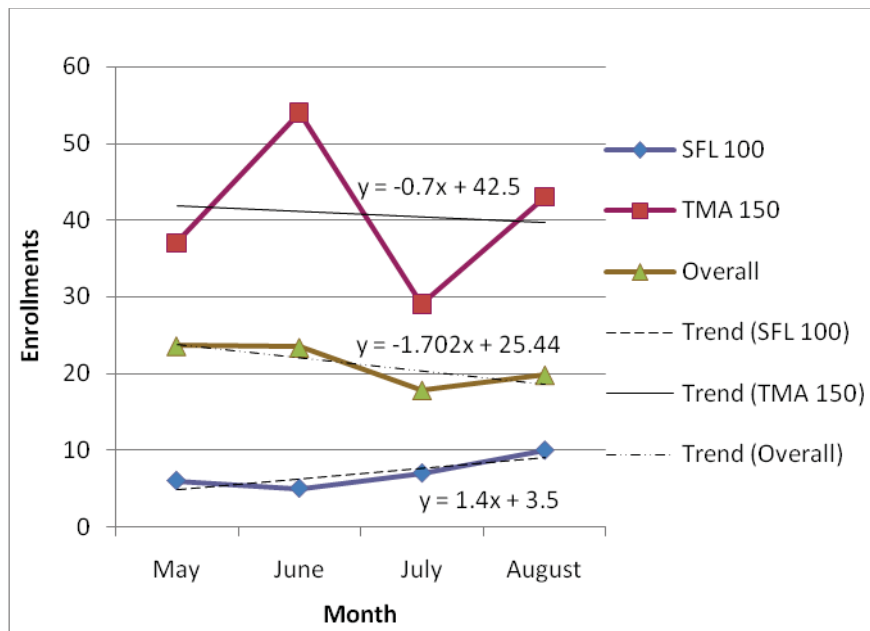


Figure:1. TMA 150, SFL 100, and all university courses enrollment trends.

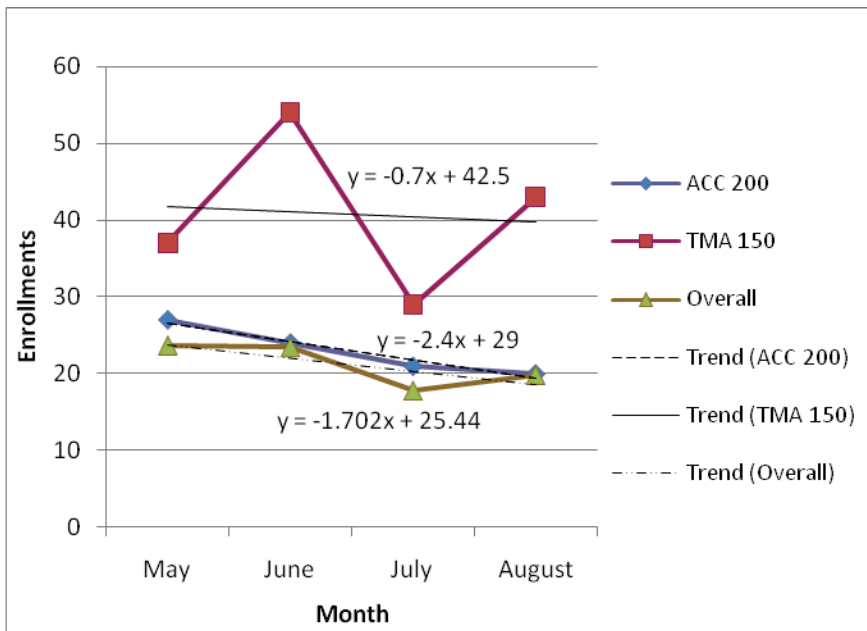


Figure 2: TMA 150, ACC 200, and all university courses enrollment trends.

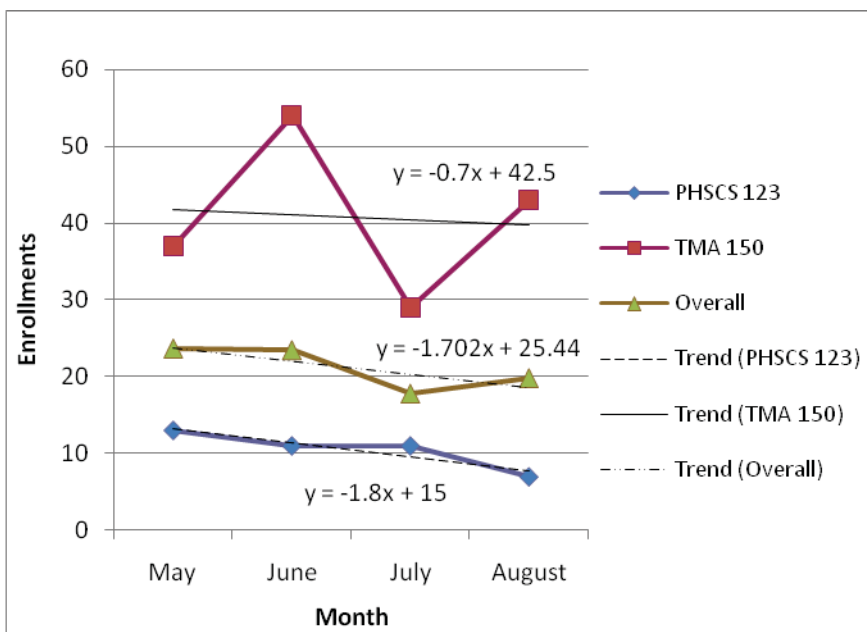


Figure 3: TMA150, PHSCS 123, and all university courses enrollment trends.

The three figures show that the trend line for paid enrollment in TMA 150 continued to be nearly parallel with the trend line for the control courses, as well as the trend line for overall university enrollment, after it was opened. While enrollment in TMA 150 is trending slightly downward, the slope of the enrollment trend line is more positive for TMA 150 than it is for ACC 200, PHSCS 123, and university enrollments overall. The slope of the trend line for SFL 100 is even more positive. As noted, the limited amount of data did not allow calculations of statistical significance. However, the trends lines do not reveal any major differences or suggest that significant changes occurred. From a practical standpoint, the figures suggest that opening the course did not negatively impact paid enrollment.

While the figures demonstrate no change in the trend line for enrollment, the question of potential changes in the magnitude of enrollment (Y-axis) must also be addressed. Table 4 shows the percentage change in (a) enrollment for the opened course, (b) the three control courses, and (c) overall university enrollment for paired months in 2008 and 2009 (e.g., the difference between May 2008 and May 2009). The difference in actual enrollment numbers is also included in the table to provide a sense of scale. Please note that these are not enrollment numbers, but are the change in enrollments numbers from 2008 to 2009. The most significant aspect of this data is the average change in the final column. The data shows that enrollment in TMA 150 (the opened course) was up 22% for the pilot period as compared to the same period during 2008, while SFL 100 enrollment was down 10%, ACC 200 enrollment was down 16%, and overall university enrollment went up only 8%. Only PHSCS 123 enrollment was up more than TMA 150, with an

increase of 125%. Thus, the TMA 150 course seemed to perform well relative to the previous year and the comparative controls.

Table 4

TMA 150 - Change in Paid Enrollment by Month Comparing 2008 and 2009

Course	May		Jun		Jul		Aug		Average	
	#	%	#	%	#	%	#	%	#	%
TMA 150	-12	-24%	26	93%	0	0%	7	19%	5	22%
SFL 100	-8	-57%	1	25%	1	17%	-3	-23%	-2	-10%
ACC 200	-14	-34%	-2	-8%	-5	-19%	-1	-5%	-6	-16%
PHSCS 123	-1	-7%	5	83%	7	175%	5	250%	4	125%
ALL UNIV COURS	119	5%	209	10%	180	11%	106	6%	154	8%

University Course #2: School of Family Life 110 (SFL 110) – Food Preparation in the Home. Enrollment in SFL 110 most closely correlated with enrollment in the courses listed in Table 5.

Table 5

Enrollment Correlations with SFL 110

Course	Correlation
HIST 322 - English History to 1689	0.94
ENGL 292 - British Literary History 2	0.89
MANEC453 - Money, Banking, and Business	0.85

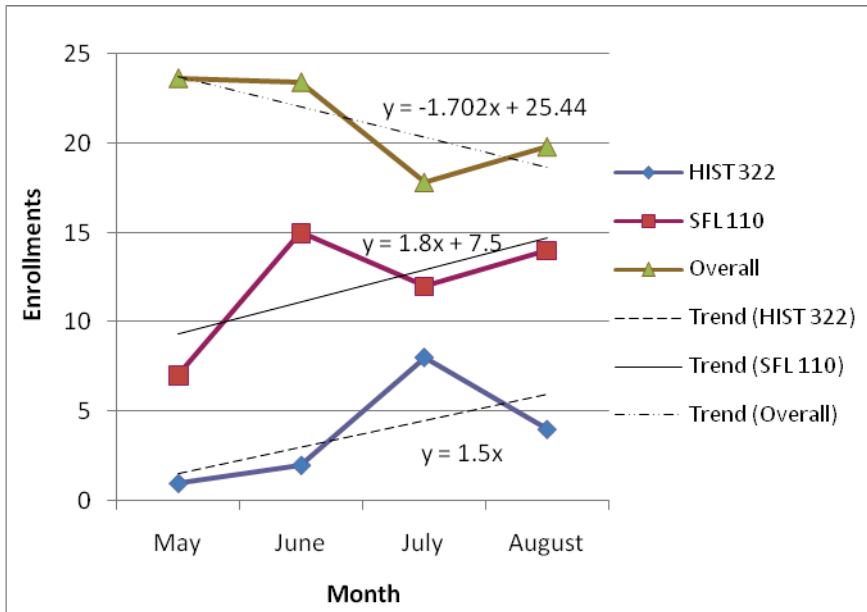


Figure 4: SFL 110, HIST 322, and all university courses enrollment trends.

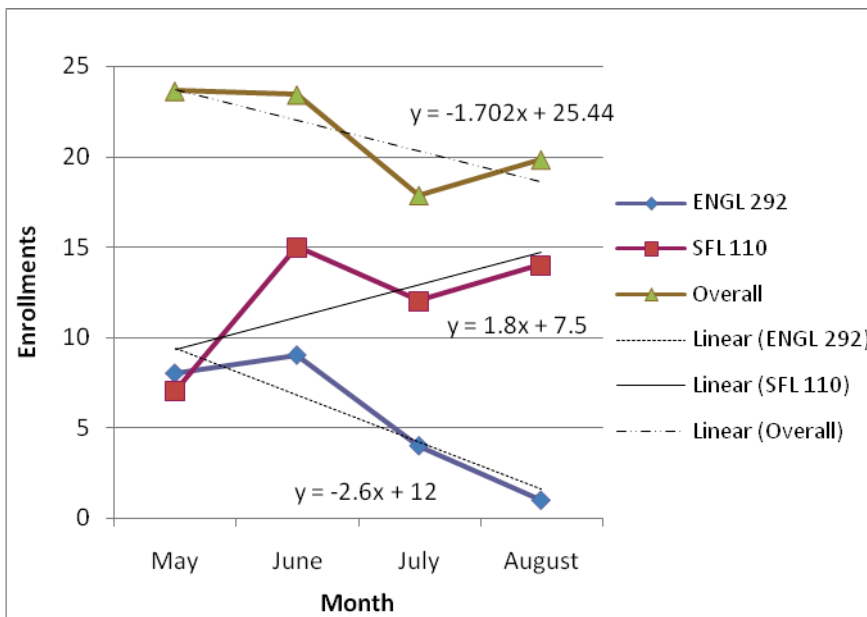


Figure 5: SFL 110, ENGL 292, and all university courses enrollment trends.

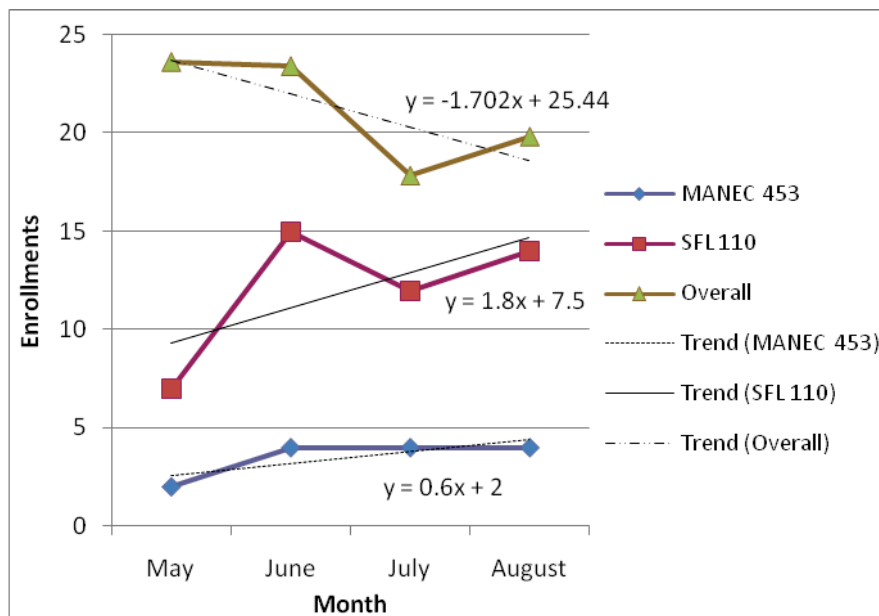


Figure 6: SFL 110, MANEC 453, and all university courses enrollment trends.

Figures 4, 5, and 6 (above) illustrate enrollment trends in SFL 110 compared with the three control courses, and with overall university course enrollment trends. These three figures show that after opening SFL 110 as an OCW course, the trend line for paid enrollment in the course was similar to the trend line for enrollment in HIST 322, and was more positive than both the trend lines for the other two control courses and the trend line for overall university enrollment. While the trend lines suggest that enrollment in SFL 110 improved after opening the course, there is insufficient data to determine whether the potential differences are statistically significant. The figures suggest that opening the course did not negatively impact paid enrollments in the opened course.

The paired-months data in Table 6 show that paid enrollment in SLF 110 was down 5% from the prior year, which was stronger than MANEC 453 (down 38%) but not as strong as HIST 322 (down 1%), ENGL 292 (up 40%), or overall university enrollment (up 8%). SLF 110 has a positive trend line, but it underperformed overall university enrollment and the enrollment trends for two of the control courses when compared to the prior year.

Table 6

SFL 110 - Change In Paid Enrollment by Month Comparing 2008 and 2009

Course	May		Jun		Jul		Aug		Average	
	#	%	#	%	#	%	#	%	#	%
SFL 110	-19	-73%	-2	-12%	5	71%	-1	-7%	-4	-5%
HIST 322	-6	-86%	-4	-67%	5	167%	-1	-20%	-2	-1%
ENGL 292	1	14%	5	125%	2	100%	-4	-80%	1	40%
MANEC 453	-7	-78%	-5	-56%	0	0%	-1	-20%	-3	-38%
ALL UNIV COURES	119	5%	209	10%	180	11%	106	6%	154	8%

University Course #3: Business Management 418 (BUSM 418) – Personal Finance.

Enrollment in BUSM 418 most closely correlated with enrollment from courses in Table 7.

Figures 7, 8, and 9 illustrate enrollment trends in BUSM 418 compared with the three control courses, and with overall university course enrollment trends.

Table 7
Enrollment Correlations with BUSM 418

Course	Correlation
ISYS 101 - Computer Presentation Skills	0.76
ANTHR 312 - Intercultural Communication	0.67
SOC 350 - Introduction to Social Psychology	0.61

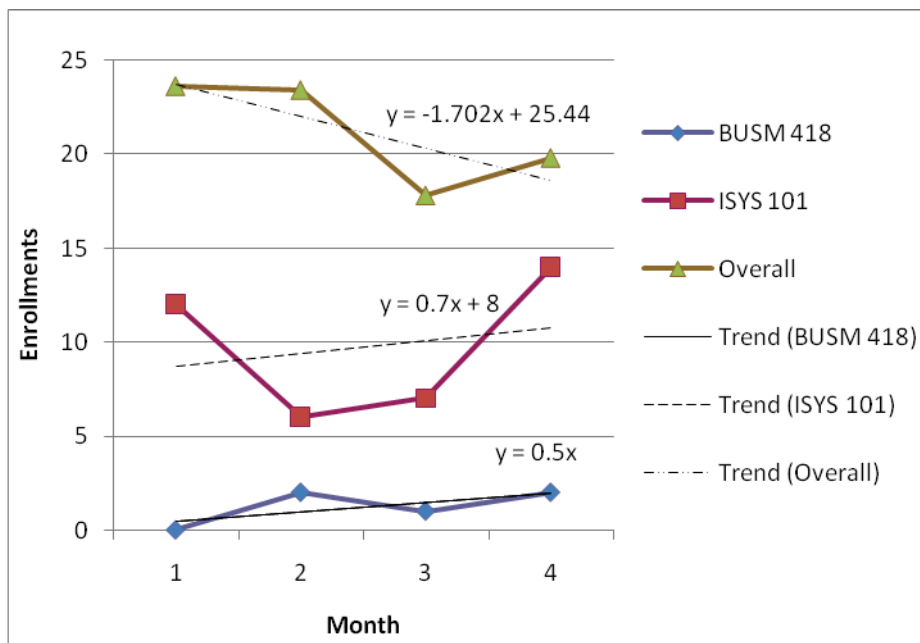


Figure 7: BUSM 418, ISYS 101, and all university courses enrollment trends.

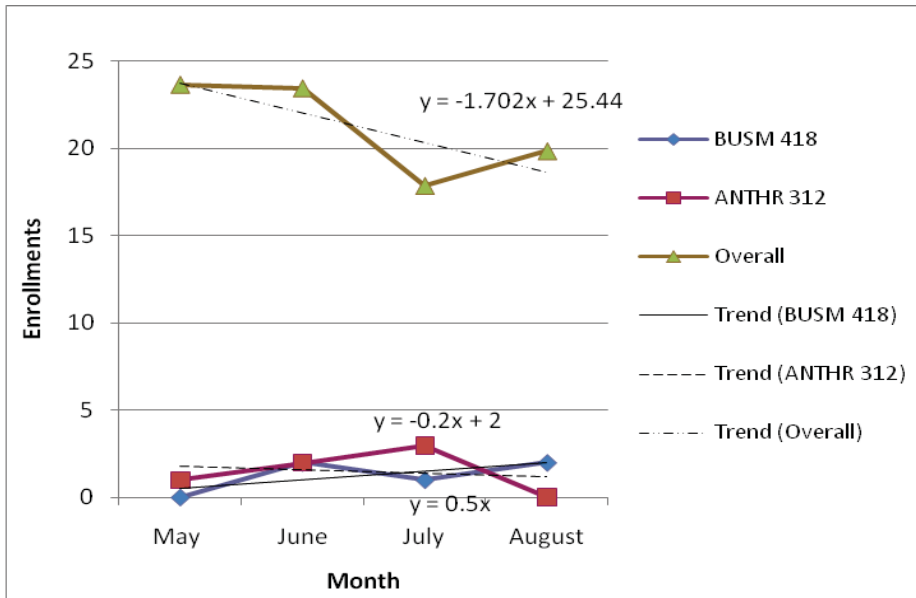


Figure 8: BUSM 418, ANTHR 312, and all university courses enrollment trends.

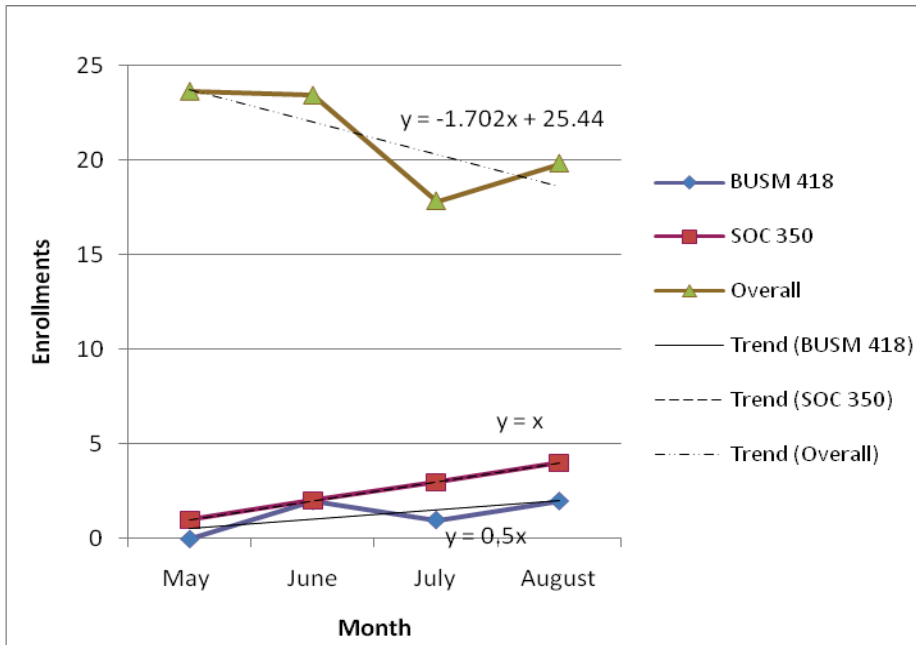


Figure 9: BUSM 418, SOC 350, and all university courses enrollment trends.

The three figures show that after opening BUSM 418 as an OCW course, its trend line for paid enrollment was nearly parallel with the trend lines for SOC 350 and ISYS 101 and was more positive than the trend lines for ANTHR 312 and university courses overall. Again, the figures suggest that opening the course did not negatively impact paid enrollment.

The paired-months data in Table 8 shows that BUSM 418 enrollment was up 50% from last year, which was higher than ANTHR 312 (down 25%), SOC 350 (up 46%), and overall university enrollment (up 8%). ISYS 101 enrollment was up more than BUSM 418, with an increase of 477% over last year. However, BUSM 418 had very low enrollments in both 2008 and 2009, so this data should be considered with caution.

Table 8
BUSM 418 - Change In Paid Enrollment by Month Comparing 2008 and 2009

Course	May		Jun		Jul		Aug		Average	
	#	%	#	%	#	%	#	%	#	%
BUSM 418	0	0%	1	100%	0	0%	1	100%	1	50%
ISYS 101	12	1200%	5	500%	-5	-42%	10	250%	6	477%
ANTHR 312	-1	-50%	0	0%	1	50%	-1	-100%	0	-25%
SOC 350	-2	-67%	1	100%	1	50%	2	100%	1	46%
ALL UNIV COURES	119	5%	209	10%	180	11%	106	6%	154	8%

High School Course #1: Government 45 (GOVT 45) - United States Government and Citizenship. Enrollment in GOVT 45 most closely correlated with enrollments in the courses listed in Table 9.

Table 9

<i>Enrollment Correlations with GOVT 45</i>	
Course	Correlation
GOLF 41 – Golf	0.88
ALG 43 - Pre-Algebra, Part 2	0.87
ENGL 57 - Twelfth-Grade English	0.86

Figures 10, 11, and 12 illustrate enrollment trends in GOVT 45 compared with enrollments for the three control courses and with overall enrollment trends for high school courses.

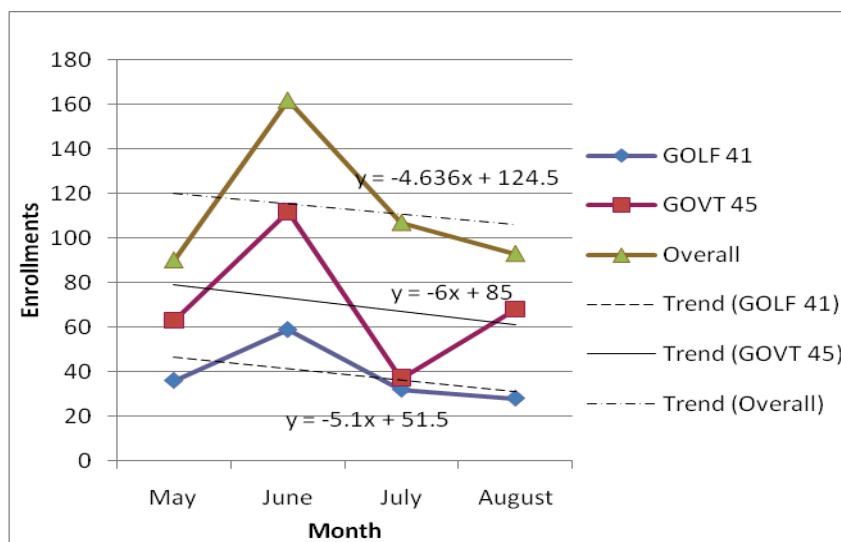


Figure 10: GOVT 45, GOLF 41, and all high school courses enrollment trends.

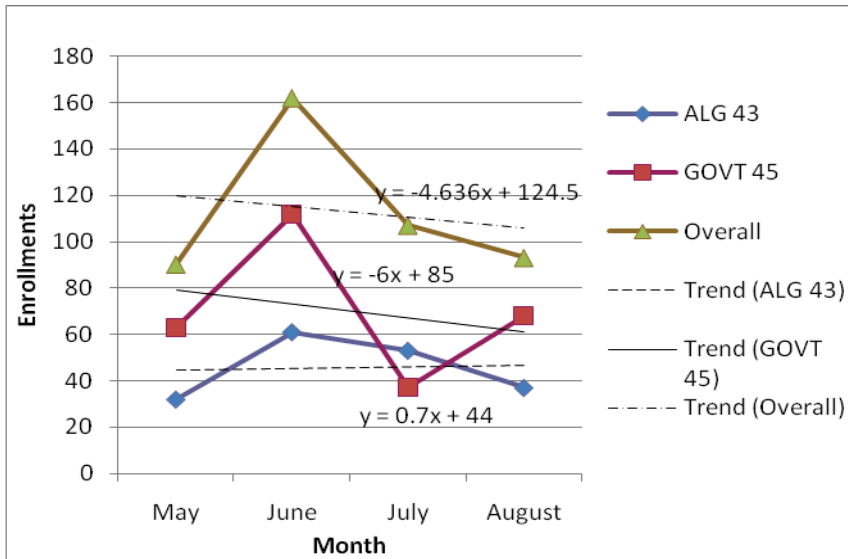


Figure 11: GOVT 45, ALG 43, and all high school courses enrollment trends.

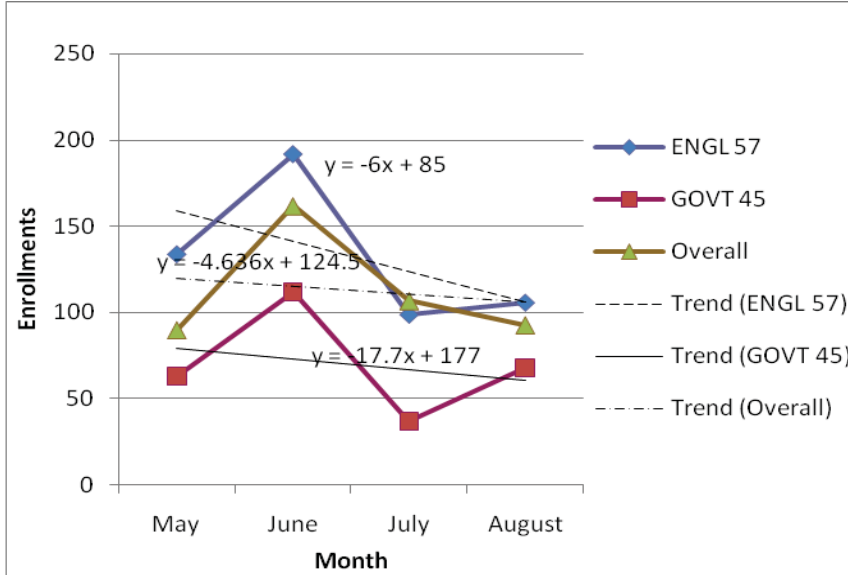


Figure 12: GOVT 45, ENGL 57, and all high school courses enrollment trends.

The three figures show that after opening GOVT 45 as an OCW course, the trend line for paid enrollment in the course continued to echo enrollment in GOLF 41 and overall high school enrollment. The trend line for ENGL 57 was more negative and the trend line for ALG 43 was more positive. Visual inspection of the figures suggests that nothing significant is happening. While enrollment in GOVT 45 trended slightly downward, so did enrollment in high school courses overall, as well as enrollment in GOLF 41 and ENGL 57. From a practical standpoint, the figures suggest that opening the course did not negatively impact paid enrollment in the opened course.

The paired-months data showed that GOVT 45 enrollment was up more than ALG 43, ENGL 57, and overall high school enrollments. GOLF 41 enrollment grew more from the previous year than did GOVT 45 enrollment. Again, the data suggest that the course is performing well, and that opening it did not negatively impact paid enrollment.

Table 10

GOVT 45 - Change In Paid Enrollment by Month Comparing 2008 and 2009

Course	May		Jun		Jul		Aug		Average	
	#	%	#	%	#	%	#	%	#	%
GOVT 45	-31	67%	13	13%	-23	-38%	27	66%	-4	27%
GOLF 41	8	129%	6	11%	4	14%	16	133%	9	72%
ALG 43	-8	-20%	-15	-20%	16	43%	13	54%	2	14%
ENGL 57	-70	-34%	-30	-14%	-19	-16%	10	10%	-27	-13%
ALL HS COURSES	-838	-9%	-2712	-14%	-350	-3%	-698	-7%	-1150	-8%

High School Course #2: Earth Science, Part 1– Earth 41 (EARTH 41). Enrollments

in EARTH 41 were most closely correlated with enrollments in the courses listed in Table 11.

Table 11

<i>Enrollment Correlations with EARTH 41</i>	
Course	Correlation
ALG 41 - Pre-Algebra, Part 1	0.89
CHEM 45 - Chemistry, Part 1	0.87
ENGL 51 - Eleventh-Grade English 1	0.87

Figures 13, 14, and 15 illustrate enrollment trends in EARTH 41 compared with enrollments in the three control courses and with overall high school course enrollment trends.

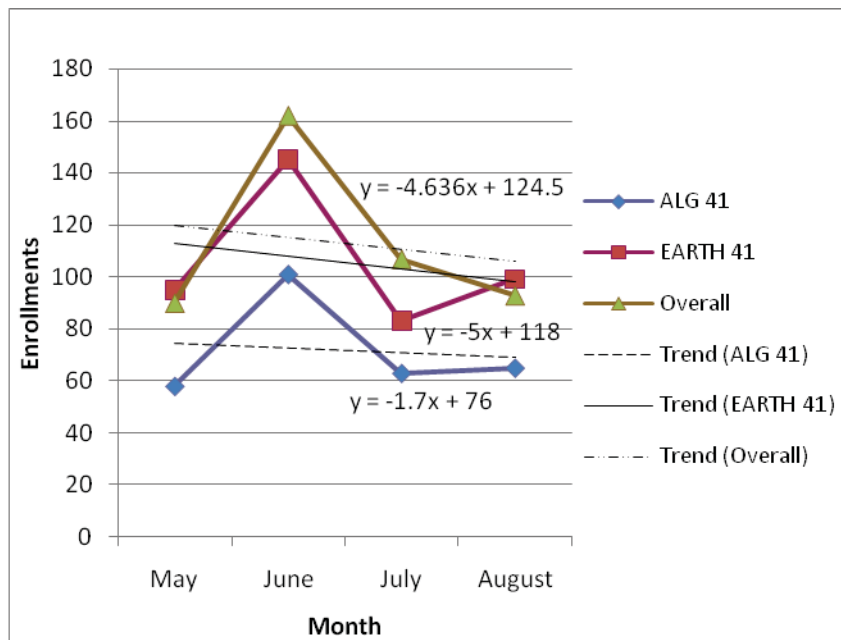


Figure 13: EARTH 41, ALG 41, and all high school courses enrollment trends.

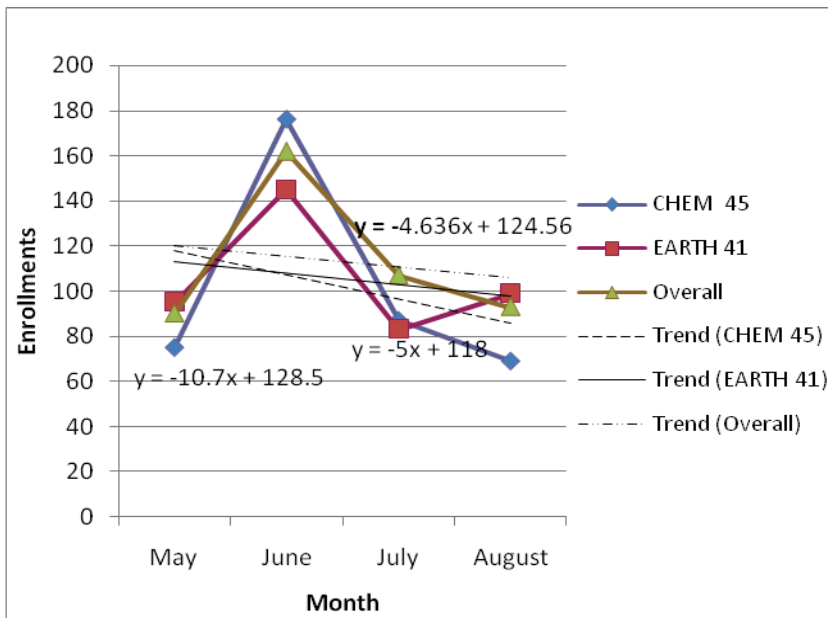


Figure 14: EARTH 41, CHEM 45, and all high school courses enrollment trends.

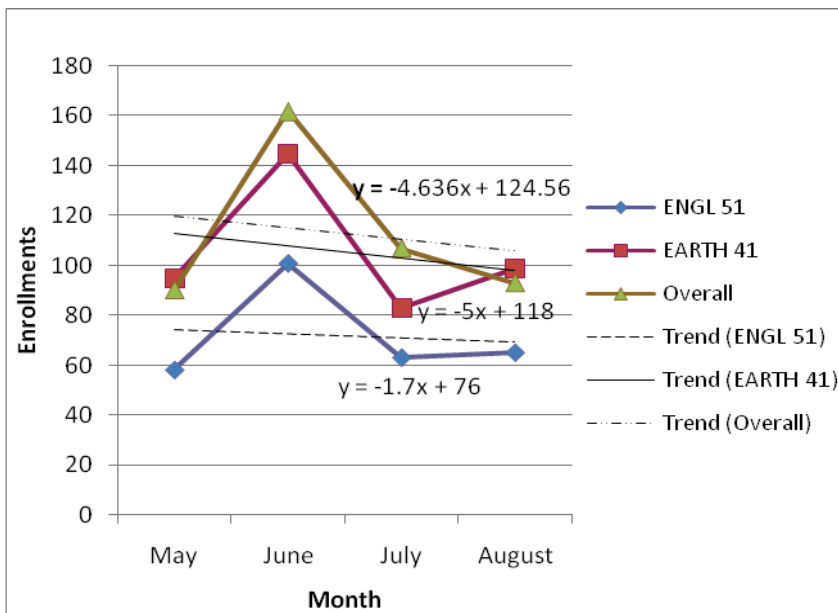


Figure 15: EARTH 41, ENGL 51, and all high school courses enrollment trends.

The three figures show that after opening EARTH 41 as an OCW course, the trend line for paid enrollments in the course was similar to the trend lines for enrollment in the control courses (ALG 41, CHEM 45, and ENGL 51) and with the trend line for overall high school enrollment.

The paired-months data shows that paid enrollments increased more in EARTH 41 at 16% than ALG 41 (up 12%), CHEM 45 (up 9%), ENGL 51 (down 8%), and overall high school enrollment (down 8%). From a practical standpoint, the course is doing well compared to the controls and overall enrollments. Opening the course did not have a negative impact on paid enrollment.

Table 12

EARTH 41 - Change in Paid Enrollment by Month Comparing 2008 and 2009

Course	May		Jun		Jul		Aug		Average	
	#	%	#	%	#	%	#	%	#	%
EARTH 41	21	128%	-2	-1%	-39	-32%	-41	-29%	-15	16%
ALG 41	-4	94%	-9	-8%	-6	-9%	-26	-29%	-11	12%
CHEM 45	10	15%	28	19%	16	23%	-19	-22%	9	9%
ENGL 51	-20	-10%	-22	-5%	11	5%	-53	-21%	-21	-8%
ALL HS COURSES	-838	-9%	-2712	-14%	-350	-3%	-698	-7%	-1150	-8%

High School Course #3: Geography 41(GEOG 41) – World Geography: The Forces That Shape Our World. Enrollment in GEOG 41 most closely correlated with enrollment in the courses listed in Table 13.

Table 13

Enrollment Correlations with GEOG 41

Course	Correlation
HUM 41 - Humanities 1: The Performing Arts	0.94
PHYS 41 - General Physical Science	0.93
HIST 43 - United States History from 1851	0.93

Figures 16, 17, and 18 illustrate enrollment trends in GEOG 41 compared with the enrollments in three control courses and with overall high school course enrollment trends.

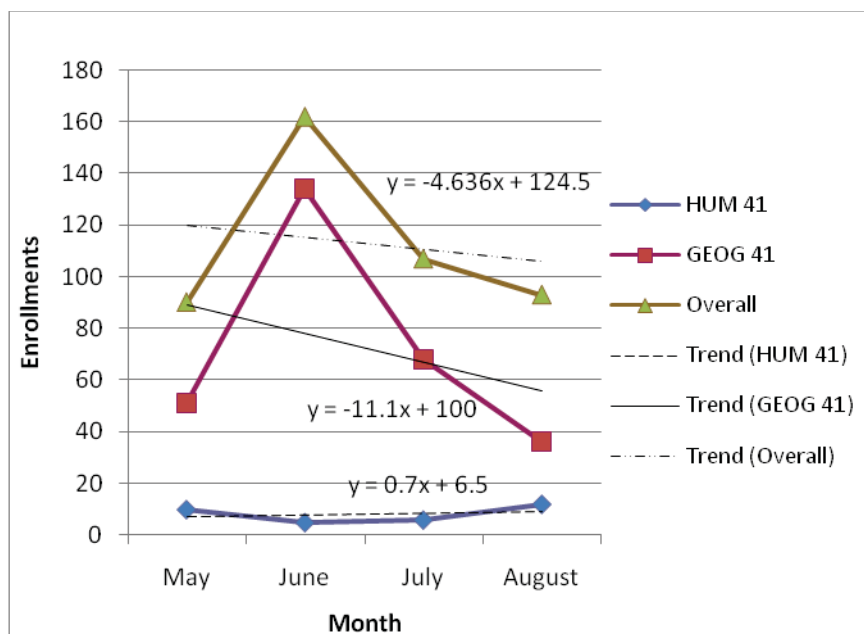


Figure 16: GEOG 41, HUM 41, and all high school courses enrollment trends.

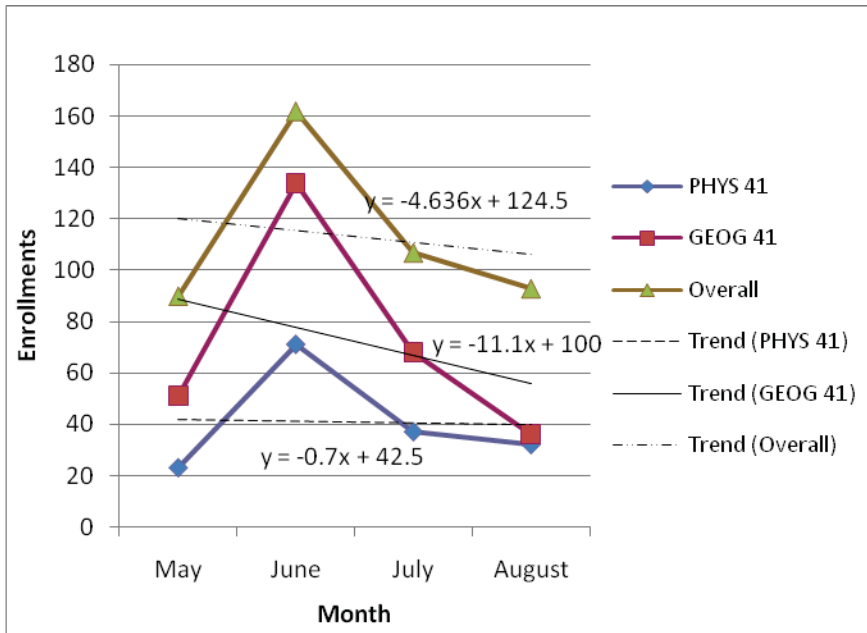


Figure 17: GEOG 41, PHYS 41, and all high school courses enrollment trends.

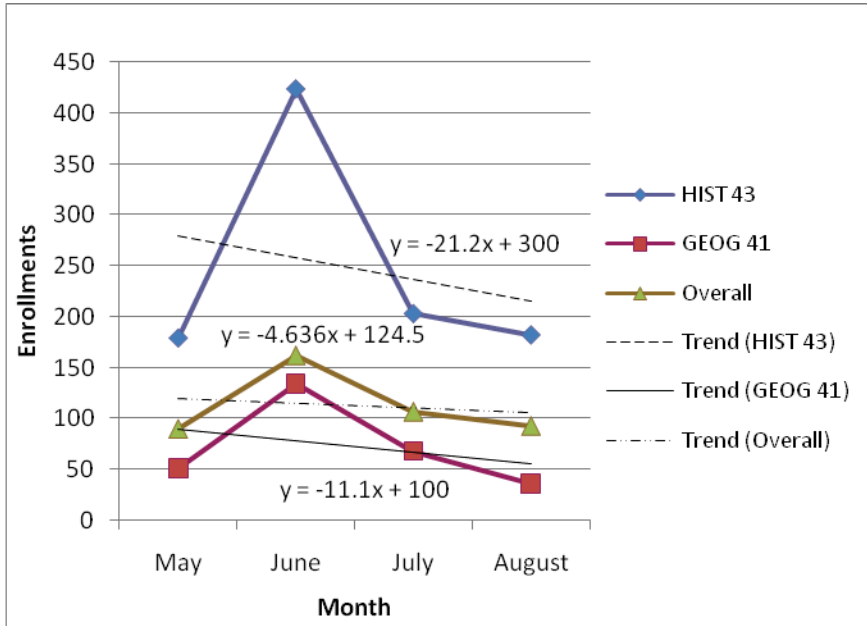


Figure 18: GEOG 41, HIST 43, and all high school courses enrollment trends.

The three figures show that after opening GEOG 41 as an OCW course, the trend line for paid enrollments was slightly more negative than the trend line for PHYS 41, HUM 41, and high school enrollments overall. However, Table 14 shows that paid enrollment in GEOG 41 also increased 31%, which was more than all three of the control courses and overall high school courses (down 8%). The course enrollments appeared to be trending down, but were still better than last year. Together, the data seem to suggest that opening the course did not negatively impact paid enrollment.

Table 14
GEOG 41 - Change in Paid Enrollment by Month Comparing 2008 and 2009

Course	May		Jun		Jul		Aug		Average	
	#	%	#	%	#	%	#	%	#	%
GEOG 41	17	50%	16	14%	15	28%	9	33%	14	31%
HUM 41	-2	-17%	-19	-79%	-9	-60%	0	0%	-8	-39%
PHYS 41	-15	-39%	-57	-45%	-27	-42%	-12	-27%	-28	-38%
HIST 43	-3	-2%	-16	-4%	-18	-8%	32	21%	-1	2%
ALL HS COURSES	-838	-9%	-2712	-14%	-350	-3%	-698	-7%	-1150	-8%

In summary, the figures and the paired-month enrollment data suggest that there was no practical change in the levels of paid enrollments. That is, opening the courses provided neither a large positive marketing effect that boosted enrollments nor a large negative free rider impact decreasing enrollments. These data address the common concern that openly publishing distance learning courses could cost a program paid enrollments as students use the free content and

choose not to enroll in the course. As noted, the limited amount of data did not allow an analysis of statistical significance. However, the data are sufficient to alleviate concerns that opening the courses could seriously reduce paid enrollment.

Visits, Hits, and Conversion from OCW Courses. Google Analytics tools collected information about visitor traffic to the six OCW courses during the study period. The researcher viewed visits to OCW courses as a potentially positive benefit for BYU IS, as those courses drew in new potential customers. As OCW users browsed courses, Google Analytics captured information such as the number of visits and page views for each course. At the same time, a browser cookie was set when OCW users visited any OCW course to track people who later registered in a regular BYU IS course. Another cookie tracked whether users clicked the enroll button in the OCW course to convert to a paid enrollment. Table 15 and 16 summarize visits and page views for each of the six opened courses.

Table 15
University Courses May - Aug 2009

Course	Visits	Page Views
TMA 150	1,904	8,535
BUSM 418	1,567	4,467
SFL 110	2,102	11,355

Table 16

High School Courses May - Aug 2009

Course	Visits	Page Views
GOVT 45	1,476	14,219
EARTH 41	1,046	8,963
GEOG 41	803	8,449

In total, the OCW courses had 13,795 visits and 71,224 page views – with minimal marketing. Of the 13,795 people who visited an OCW course, 2.6% (358) of visitors eventually paid for and enrolled in one or more courses, for a total of 445 paid enrollments during the pilot period.

The cookies that tracked enrollments following a visit to OCW functioned like the code on an advertising instrument that asks customers to enter a promotional code at the point of purchase. The code lets the advertiser track the number of sales that resulted from a certain form of advertising (e.g., a radio ad or billboard). The cookies used for this study tracked OCW visitors’ paid enrollments in much the same way.

Analysis of browser cookie data showed that 358 OCW users paid to enroll in a total of 445 courses. Of the 445 total enrollments from OCW visitors, 414 were from people who visited on OCW course and later enrolled through BYU IS’s regular Web-based registration. Of those 414 enrollments, 146 were enrollments in university courses and 299 were in high school courses. Of the 445 total enrollments, 36 came from OCW users who clicked the enroll button

inside an OCW course. Of those, 16 were enrollments in university courses and 20 were enrollments in high school courses.

Sustainability of OCW within BYU IS

For the purposes of this study, visitor enrollments were considered to be either weakly attributable to OCW or strongly attributable to OCW based on the method each used to enroll in the paid version of the course:

1. *Weakly Attributable* – a visitor enrolled in a BYU IS course at any time after viewing an OCW course (for example, if the visitor viewed an OCW course and enrolled a week later through the regular BYU IS online registration process).
2. *Strongly Attributable* – a visitor enrolled using the “enroll now” button inside an OCW course.

The cookies that identified enrollment from OCW visitors did not track which courses people viewed before paying to enroll in a course. Table 17 shows a summary of the number of paid enrollments attributable to each OCW course each month.

Table 17
Average Monthly Attributable Enrollments Per OCW Course

Course	Strong	Weak
University Courses	1.33	12.17
High School Courses	1.67	24.92

If the conversion rates for the four months of the study are typical, then an average of 146.04 new university enrollments and 299.04 new high school enrollments could be expected each year for each OCW course under the weakly attributable model. Under the strongly attributable model, 15.96 new university enrollments and 20.04 new high school enrollments could be expected each year from each OCW course.

While incremental improvements are constantly made to BYU IS courses, they go through a major course redesign every four years on average. BYU IS assumes a four-year lifecycle to estimate ROI when funding course projects. Likewise, OCW versions of BYU IS courses would need to be redeveloped every four years to keep them in alignment with the current BYU IS courses. To be sustainable over the long term, the return on investment (ROI) period for openly published courses would therefore have to average four years or less.

Tables 18 and 19 illustrate the profit margins that BYU IS would have to maintain for OCW to be a long-term, financially self-sustaining initiative (assuming a 4-year ROI period). In this context, *self-sustaining* means that the profits from new paid enrollments attributable to openly published courses over the ROI period must be equal to the cost of opening the courses. Table 18 uses figures based on strongly attributable enrollments. Table 19 uses figures based on weakly attributable enrollments.

As the tables show, enrollments that can be weakly attributed to OCW generate enough additional revenue that the profit margin for university courses would need to be 0.11% of tuition to cover the cost of opening a course (this assumes that the entire margin would be dedicated to funding OCW courses).

Table 18

Sustainability - Strongly Attributable Enrollments

Course Type	Estimated Conversion Cost	ROI Years	Anticipated 4-Year Enrollment	Typical Tuition Rate	Estimated 4-Year Revenue	Margin Required for Sustainability
University	\$284.12	4	63.84	\$444.00	\$28,344.96	1.00%
High School	\$1,172.71	4	80.16	\$124.00	\$9,939.84	11.80%
All Courses	\$728.42	4			\$19,142.40	3.81%

Table 19

Sustainability - Weakly Attributable Enrollments

Course Type	Estimated Conversion Cost	ROI Years	Anticipated 4-Year Enrollment	Typical Tuition Rate	Estimated 4-Year Revenue	Margin Required for Sustainability
University	\$284.12	4	584.16	\$444.00	\$259,367.04	0.11%
High School	\$1,172.71	4	1196.16	\$124.00	\$148,323.84	0.79%
All Courses	\$728.42	4			\$203,845.44	0.36%

Taking a more conservative approach and only attributing to OCW those enrollments that occurred when an OCW user clicked the “enroll now” button inside a course, the required profit margin for sustainability of university OCW courses increases to 1.00%.

High school courses were more expensive to convert to OCW. Depending on the revenue from weakly attributable enrollments would require a marginal profit of 0.79% over four years to recover the cost of opening a course. Relying solely on the strongly attributable enrollments would require a marginal profit of 11.80% over four years to break even.

When the data for university and high school courses are combined, the overall BYU IS profit margin required for sustainability under the strongly attributable model is 3.81% and the margin required for sustainability under the weakly attributable model is 0.36%. If BYU IS's profit margins are higher than those required for sustainability, then a long-term OCW initiative at BYU IS could be revenue positive.

Chapter 5: Discussion of Findings

The purposes of this study were to measure the cost of converting BYU IS courses to OCW, examine the impact of opening courses on paid enrollment, and assess the financial sustainability of openly publishing BYU IS courses. This chapter discusses the findings for each of the study's research questions, identifies areas for improvement, and offers recommendations for future research.

The Cost of Opening BYU IS Courses

Based on data from USU and considering the unique aspects of BYU IS courses, the initial cost estimate for opening each university and each high school course was \$3,000. In reality, the cost to open the first university and the first high school course was higher than the \$3,000 estimate – \$3,489 for the first university course (TMA 150) and \$5,204 for the first high school course (GOVT 45). However, the cost decreased dramatically for the subsequent courses. The average cost to open the next two university courses (BUSM 418 and SFL 110) was \$284.12 and the average cost to open the next two high school courses (EARTH 41 and GEOG 41) was \$1,172.71. These cost decreases were due to the increasingly automated conversion process of opening the courses (realized through the development and reuse of XML transforms).

The average cost to open the second and third high school courses was 413% higher than the cost to open the second and third university courses (\$1172.71 and \$284.12 respectively). Perhaps the approach used to develop and convert the high school courses could be modified to benefit from the efficiencies experienced with the university courses.

One strength of the study was the accuracy with which the cost to open the courses was tracked. Everyone who worked on the project billed their time in 15-minute increments. Those figures were combined with actual salary data to calculate labor costs. A project manager ensured that time was billed regularly and accurately.

The pilot program for this study also benefited from the fact that BYU IS content was already in a digital format and was originally developed for web-based delivery. BYU IS's longstanding efforts to avoid the use of copyrighted materials realized additional cost savings. However, the major reason the costs to convert these courses was so low was BYU IS's use of XML and XSLT transform programs, which are designed to facilitate repurposing and reusing content. Without these types of technologies, the decrease in cost for converting the second and third courses would have been much smaller. The impact of the XML transforms is illustrated by the fact that the cost to develop the first of each course type, along with the required XML transform, was higher than the combined cost of developing the second and third courses. It is important to note that research costs associated with the study that were unrelated to opening the courses (e.g., literature review, data analysis, and writing) are not included in the figures.

Another factor that helped keep costs low was the fact that the open courses were converted and delivered using existing infrastructure (e.g., building space, computers, and servers), as opposed to other OCW projects which used dedicated resources. BYU IS's existing infrastructure is made possible by paid enrollments in credit-bearing courses. The cost-sustainable OCW model this study examined presumes a significant existing infrastructure of online course development and publishing.

While the profit margins necessary for BYU IS to sustain a program of open publishing are surprisingly low, the opportunity cost of spending a portion of BYU IS's margin on open publishing must be considered. BYU IS already allocates its existing profit margin to a variety of strategic university priorities. Spending some of that margin on open publishing would divert funds from other initiatives. Another opportunity cost lies in the fact that resources such as personnel, office space, and equipment are already in short supply for BYU IS. Even if OCW courses are financially self-sustaining, limitations on hiring, adding office space, and equipment purchases could make it difficult for BYU IS to translate new revenue from OCW into additional production capacity to support an OpenCourseWare initiative.

The Impact of OpenCourseWare on Paid Enrollment

The relatively small amount of data gathered for this study prevented a purely statistical analysis of the impact of opening courses on paid enrollment. However, the trend data suggests that opening the courses did not have a significant negative or positive impact on paid enrollment. It is interesting to note that all three opened high school courses outperformed two or more of their respective control courses as well as overall enrollment (when paid enrollment in 2009 was compared to paid enrollment in 2008). Two of the three opened university courses also outperformed two or more of their respective control courses as well as overall university enrollment (when paid enrollments in 2009 was compared to paid enrollment in 2008).

While again statistical significance could not be calculated, the enrollments attributable to OCW are practically significant. Both the weakly attributable and strongly attributable models demonstrate that even modest financial margins would sustain an ongoing OCW program at

BYU IS through the generation of new paid enrollments. Data collection should continue to allow a more detailed data analysis based on at least twelve months of enrollment data.

The Sustainability of OCW within BYU IS

With modest assumptions about the BYU IS profit margin, OCW-style open publishing appears to be both sustainable and even potentially revenue positive. Using the most conservative data (from strongly attributable enrollments) and a four-year repayment period, the BYU IS profit margin would have to be 1.00% to repay the cost of opening university courses and 11.80% to repay the cost of opening high school courses. Using data from the weakly attributable enrollments and a four-year repayment period, the BYU IS margin would have to be 0.11% to repay the cost of opening university courses and 0.79% to repay the cost of opening high school courses. There is an assumption in these numbers that the lifecycle of the OCW course will be the same as the lifecycle of the regular course. If an OCW course was opened later than the regular course, the ROI period for the OCW course would be shorter. For example, if an OCW course is developed from a regular course that has only two years until it has to be revised, then the ROI period for that OCW course would be two years instead of four and the course would require a higher profit margin to repay the cost to open it.

When the data for university and high school courses are combined, the overall profit margin required for a BYU IS open publishing initiative to reach sustainability under the strongly attributable model is 3.81% and the margin required for sustainability under the weakly attributable model is 0.36%. Should costs unexpectedly increase, or the repayment period shorten, the profit margin for sustainability would be higher.

Ways to Improve the Study

As noted, one weakness of this study was that it was not possible to meet all of the course-selection criteria. In particular, lower-enrolling courses were selected for the pilot to ensure faculty support. Should BYU continue with a larger OCW program, data from this study will likely help build faculty support for opening higher-enrolling courses.

The short duration and limited scope of the study also present areas for improvement. This study was approved as a limited pilot to control risks to BYU IS. Prior to this study, there was no empirical data on the impact of openly publishing courses on paid enrollment in those courses. It was entirely possible that opening these six courses would have a major financial impact. Future research should include more courses and a longer duration to allow more data gathering and more rigorous statistical analysis.

The study was also limited in the approved marketing methods to promote the OCW courses. Had the courses been advertised widely and added to the OCW Consortium site (www.ocwconsotrium.org), there may have been more visitors, and thus more conversions to paid enrollment.

The study could also be improved by modifying the browser cookies to track which OCW courses people visited before paying to enroll in a course for credit. It is very possible that some courses were associated with more paid enrollments than others but the data did not allow such an analysis. Another limitation of the study's use of browser cookies is that an enrollment would not be attributed to OCW if a person visited an OCW course on one computer and later enrolled from another computer, leading to a false negative in the data.

Finally, one risk of generalizing the data from this study to a larger program of opening publishing at BYU IS is the possibility that opening additional courses may not result in an answering increase in the numbers of visitors or conversions to paid enrollment. There may be a point of diminishing return at which offering a limited number of OCW courses generates nearly as many visits and conversions as would come from opening all or most of the course portfolio. Perhaps there might be a halo effect from contributing courses that draws attention to a program, but would not increase linearly as more courses are added. It is also possible that offering certain topics as OCW courses has a greater effect than other topics. Additional research will be required to understand the generalizability of the data from this study.

Recommendations for Future Research

This study has broken new ground in terms of addressing the financial impact and sustainability of OpenCourseWare. Several questions remain unanswered, and ongoing data collection and research can continue to expand our understanding of these important issues. The data-collection mechanisms put in place for this study should be allowed to continue to function to support further research based on more data. Specifically, ongoing collection of data will eventually allow statistical analyses of the impact of opening courses on paid enrollments. Additionally, the browser cookies used to track visitors' paid enrollments should be modified to record which courses OCW users visit before enrolling in the paid version of a course.

The results of this study are encouraging, but should by no means be considered the final word on the matter. There are still risks and unknowns that need further investigation. Should BYU IS choose to continue a program of open publishing, this study should be expanded to

include additional courses through a phased approach with evaluation and analysis along the way.

This study considered enrollments to be weakly or strongly attributable to OCW and did not attempt to address causation. The number of enrollments that are truly attributable to OCW is likely somewhere between these two extremes. One significant research opportunity would be to conduct a follow-up survey of OCW visitors who enrolled for credit to collect data about the extent to which the OCW courses influenced their enrollment decisions.

Additional research could also be done to better understand who is using the OCW courses. If non-financial factors are considerations for an OCW program, it would be valuable to understand who uses OCW content (e.g., teachers, students, lifelong learners) and the purposes for which they use it (e.g., classroom, personal enrichment, study for campus class). It will be important to understand the impact OCW has on the constituents BYU intends to serve. A study similar to the MIT Evaluation Report (MIT OpenCourseWare, 2006) could provide valuable data on this topic, including how much BYU IS OCW users are similar to or different from MIT OCW users.

Additional research could also examine the effects of OCW on student satisfaction, drop rates, and so forth. Perhaps the ability to view a full course before enrolling leads to more informed enrollment decisions, improving satisfaction and lowering attrition.

While this study focused on the financial aspects of sustainability, a study exploring the role of OCW in relation to BYU's institutional mission would be useful, particularly because nonfinancial considerations are an important part of the BYU organizational culture. This would

require an examination of how the leaders of BYU see OCW contributing to the priorities and mission of the institution.

Finally, it would be valuable to explore the reasons why OCW users chose to pay to enroll in a course. Perhaps it is as simple as the need for credit. Understanding users' motives and needs would help inform the future direction of an OpenCourseWare program.

Contribution to the Field

This study provides a new perspective on the sustainability of OCW. Recently, realities of reduced budgets and furloughed programs have tempered the enthusiasm for the social movement behind OCW. This dissertation contributes empirical data on the impacts of openly publishing courses on paid enrollments in those courses and introduces empirical data on a financially self-sustainable model for open publishing. Both of these results contribute to the knowledge in the field of OCW research. The study also sets the stage for future research and provides empirical data to inform the ongoing dialogue about open publishing.

There is no doubt that future research will improve upon these findings. However, in an environment of uncertainty and anxiousness about open publishing, this study took a step forward by publishing OCW courses using live courses from a large financially-self-sustaining distance learning program. This first look has advanced the knowledge in the field of OpenCourseWare and will be valuable to other institutions considering an OpenCourseWare program.

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