The "Core Concepts Plus" Paradigm for Creating an Electronic Textbook for Introductory Business and Economic Statistics

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Abstract

This paper describes a flexible paradigm for creating an electronic "Core Concepts Plus" textbook (CCP-text) for a course in Introductory Business and Economic Statistics (IBES). In general terms, "core concepts" constitute the intersection of IBES course material taught by all IBES professors at the author's university. The "Plus" component of the paradigm is embodied in self-written, professor-specific sections that are combined with the core-concepts material to produce professor-specific versions of the IBES CCP-text. The paradigm entails a vertically integrated text creation process with two primary aspects: first, non-IBES faculty members that ultimately receive former IBES students are included in the text-writing process; second, some former IBES students (e.g., tutors) are included in the text-writing process. Student learning experiences with the CCP-text are summarized with survey results; the learning outcomes are assessed using three semesters of pre- and post-test data; and a textbook cost study is used to contextualize the savings to students. The CCP-text appears to be efficacious in all three of these areas. Recommendations concerning how and where the paradigm might be replicated are also presented.

1. Introduction and Motivation

Providing students with a textbook that effectively complements lecture has long been a pedagogical practice. Accordingly, tactics for improving the textbook-teacher-student interaction are worthy of study. Such improvements can assume many forms. The paradigm described in this paper focuses specifically on vertically integrating the curriculum, maximizing the textbook-professor complementarity, providing textbook cost relief to students, improving student

satisfaction and learning, and being replicable at other universities and for other courses. These five desiderata appear in Chart 1.

Chart 1: Project Desiderata

- D1: Tighten the connection between lower- and upper-level courses.
- D2: Preserve professor-specific control over textbook content and structure.
- D3: Save students money.
- D4: Improve student learning experiences and outcomes.
- D5: Create a disseminable textbook creation paradigm for other colleges and universities.

During the 2009-2011 timeframe the author created a Core Concepts Plus (CCP) textbook for Introductory Business and Economic Statistics (IBES). The project was generously funded by a grant from the Fund for the Improvement of Post-Secondary Education (FIPSE), a component of the US Department of Education. This paper constitutes a description of the project, its outcomes, and its potential for replication in other courses and at other universities.

The primary outcome of the project was a collection of four professor-specific versions of the IBES CCP-text, which was subjected to a rigorous external peer-review process like traditional IBES texts. The CCP-text was written primarily by the Principal Investigator /author (PI) with three secondary contributing authors, all of whom regularly teach IBES and are members of the economics faculty in the College of Business (COB) at the author's university.

IBES is taught exclusively by the economics faculty at the author's university, a regional comprehensive that offers several advanced degrees, but which primarily focuses on undergraduate education. Approximately 600 pre-business and economics students enroll in IBES each year, the majority of whom are sophomores. Most students that take IBES ultimately complete a major in Economics or one of the seven business majors: Accounting, Finance, Human Resources Management, Information Systems, Marketing, and Supply Chain Management.

This project was motivated by several observations about the IBES course itself and the concomitant textbooks. Traditional statistics textbooks are expensive and often include numerous add-ons and accessories of questionable value. The poor resale prospects – in part because new editions are issued with increasing frequency (Office of Operations Review and Audit 2007) – only exacerbate this issue. While some professors choose older textbook editions, the DVDs or CD-ROMs are often missing, pages are marked, needed websites have been taken down, and data sets may not be timely. Other professors opt for economical textbooks now offered by some publishing houses. While timely and less expensive, they are still more costly than necessary. As with most standard texts, these "low cost" offerings are written by authors that are not *directly* invested in the welfare of a *specific* group of students. Furthermore, IBES, more so than some other business pre-requisites, is a lynch pin to student success, both in their major and in their profession. Without good retention of material in IBES, students will encounter difficulties in many mid- and upper-level business and economics courses. A common complaint among upper-level course professors is that they must spend undue time reviewing basic statistics. And

so the search for an improved IBES experience, for both students and faculty, became the impetus for the CCP project.

The remainder of the paper is organized into three sections. The next section contains a more detailed description of the existing ideas and background that inspired the CCP approach. Section three is comprised of five subsections, each containing a discussion of how the CCP-text envelops one of the five desiderata. Section four contains summary comments and recommendations about expanding the paradigm.

2. The Genesis of the CCP Idea

One way to enhance the textbook-teacher-student interaction is to carefully combine and improve upon existing ideas. Some of the existing ideas that motivated this project were: a) the advent of electronic textbooks (e-texts) that capitalize on leading edge computer technology; b) publishing houses that permit professors to partially customize a textbook (e.g., selecting certain chapters) to fit professor-specific needs or preferences; c) publishing houses that offer less expensive paperback texts containing fewer add-ons (e.g., no DVDs with canned slide shows); and d) textbook rental programs that can reduce textbook costs for students and potentially increase the uniformity in course coverage and delivery across professors. To refine these existing ideas entails identifying where they can be improved; each of a)-d) is considered in turn below.

Alongside the many advantages of e-texts reside concerns that a sophisticated electronic-only interface may not be accessible for all students due to software compatibility issues or student-specific special needs. Students may prefer reading and studying (e.g., highlighting or making notes in page margins) from a hard-bound traditional-style textbook instead of reading from a computer screen. In fact, reading from a computer screen was the leading complaint about e-texts among our students. The portability of the e-text after the course is completed also poses questions (Clark 2008): Can it be accessed or stored so the student can reference it in future courses? Elaborate digital mechanisms (e.g., 3-d interactive models, adaptive quizzes) for creating and displaying e-texts may not easily comply with the Americans with Disabilities Act.[1] Several authors have found additional concerns regarding e-texts, such as the lack of standardization in the e-text industry (Murray and Pérez 2011) and student preference for traditional textbooks (Paxhia 2011). Woody, Daniel, and Baker (2010) note that even students with prior e-text experience generally still preferred traditional texts for learning and when using supplemental materials.

Young (2009) discusses the "Kindle Experiment" tried by Northwest Missouri State University, which serves as a cautionary tale about making a textbook "too electronic" or "only electronic" too quickly. The CCP paradigm is particularly mindful of this issue by seeking a middle ground wherein some of the basic advantages of the budding e-text paradigm (e.g., hyperlinking) are harnessed without also including a cornucopia of "nifty" electronic add-ons that the literature suggests are off-putting to students. This is accomplished by having a dual-pronged textbook offering: one version in PDF and another in hard copy. The former is made freely available through the course website and the hard copy is printed and spiral bound by the university copy

[1] For more details, see http://www.readingrights.org/digital-publishing-higher-education

center and sold to students at the cost of paper and toner (no money returns to the PI). The student is free to choose either or both formats, whichever suits their needs and preferences. The CCP paradigm may constitute a transition-type textbook genre that bridges what may be the declining era of traditional texts to the budding, but not yet familiar or standardized era of e-texts.

Many publishing houses now permit professors to order semi-custom versions of a traditional hard-copy textbook. These variations can help the professor organize the material to better match their learning goals for the course. However, these customized texts are not necessarily cheaper and they often have poor re-sale (if any). The degree to which a traditional text can be customized has some practical limitations. For example, chapters must often be ordered in a certain way to properly harness the cumulative nature of the IBES subject area.

Inexpensive hardcopy textbooks are becoming common. They feature fewer add-ons and are bound more parsimoniously – fewer glossy color photos and in paperback. These types of texts do help lower costs, but they raise questions about quality: Is the student getting what they pay for? Do the authors and publishing house editors of these texts put the same time and effort into exposition, practice problems, and solutions as they would for a higher priced textbook? Parsimoniously priced e-texts are also available, but are often cheaper because they offer fewer supplements and include access expiration dates (Clark 2008).

Textbook rental programs have some promise.[2] For example, they allow for the use of a fully functional textbook, typically with all the desired add-ons (e.g., DVDS, answer keys, web sites). The rental price is often significantly lower than the direct purchase price of the textbook, hence saving students money. The use of a single rented text across all sections and professors of a particular course can possibly increase the uniformity in the educational experience across said sections – same text, same problems, etc. Different professors using different texts for the same course may precipitate more heterogeneity in course coverage, style of exposition, and overall learning experience.

There are some imperfections in the textbook rental paradigm. First, students cannot keep the textbooks, which may be a meaningful disadvantage as they move through subsequent courses. This is especially problematic for a core course like IBES, concepts from which students will use in junior- and senior-level business and economics courses. Second, lack of text ownership may entail or incite less (or no) highlighting and note-taking in the margins, which can dull the learning process. Third, rental texts are often purchased on a large scale to enjoy cost savings, which means that professors of a large multi-section course may have to agree on a single text. This can create considerable consternation (perhaps even rancor) among professors, each of whom often has their own preferences over candidate textbooks. When one text is selected, those disenfranchised by the chosen text may be less willing and able to teach the class effectively. For example, a professor may marginalize in-class use of the rented text or cover the chapters and sections in an unusual order, either of which may erode the learning experience. Finally, a rental program entails ensconcing another layer of bureaucracy in the textbook acquisition and use process. This can be off-putting to students and faculty.

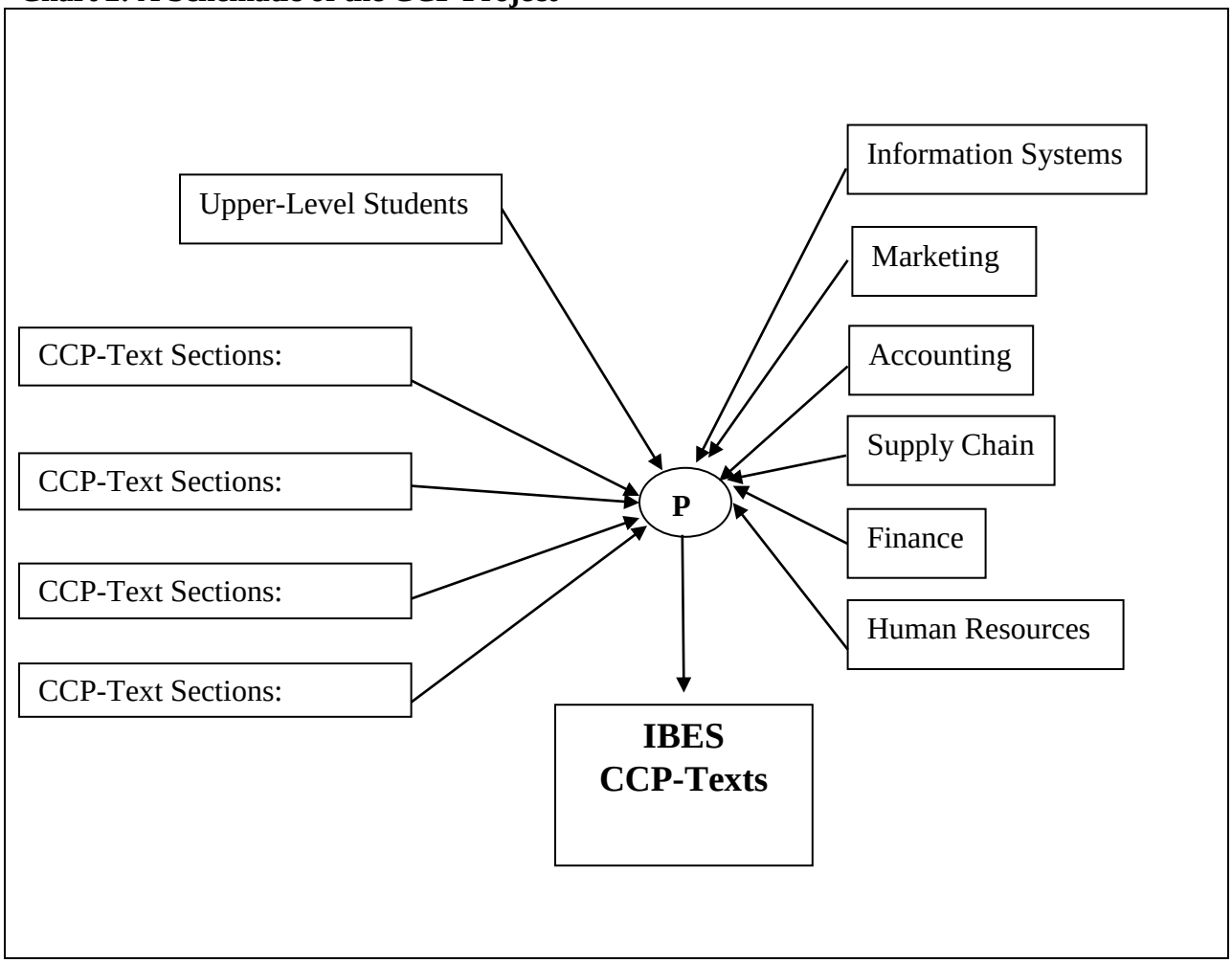
[2] One of the author's sister universities uses a text rental program, the details of which can be found at: http://www.uwsp.edu/AcadAff/Handbook/CH5-6%2012-13.pdf

The pluses and minuses of rental programs are on full display in a textbook rental system study at Appalachian State University (2006), page 19. The study notes that "In the Spring 2005 SGA survey of faculty, which had 262 respondents, 59% said they were somewhat or completely dissatisfied with the rental system" and 47% said the rental system harmed their ability to teach. The study also notes that students generally like the textbook rental idea, but appear to mostly appreciate the cost savings aspect. For example, one student stated "I like the rental system, because it saves me money, but I have found that there are many times that professors do not even use the text because they find them useless."

3. The CCP Paradigm

Mindful of these existing tools for textbook construction and delivery, the CCP paradigm, outlined in Chart 2, was crafted to meet desiderata D1-D5. This section discusses how the CCP paradigm addresses D1-D5; each is considered in turn.

Chart 2: A Schematic of the CCP Project



3. The CCP Paradigm

3.1 Desideratum D1: Vertical Integration

The first desideratum entails improving the ties between the IBES course and the mid- and upper-level courses into which it feeds. In the author's COB, there is also a junior-level business statistics course called Quantitative Business Analysis (QBA), which all business majors must take. All majors have upper-division courses containing selected topics, class presentations, individual or team-based research projects, etc. that rely on statistical competence. IBES is the course where these statistical competencies germinate. Accordingly, an opportunity to improve the flow of statistical knowledge from IBES to QBA to upper-division courses is a place where possible improvements can be made. Chart 2 contains a schematic of how this linkage was implemented. Non-IBES faculty from the business majors, listed on the right side of the chart, sent editorial comments, problems, and solutions to the PI, which were then incorporated into the CCP-text. These linkages are described in more detail in due course.

Students often forget IBES topics because they do not necessarily believe that subsequent courses will *really* use IBES material. This belief is pervasive, despite explicit reminders to the contrary by advisors and professors. The CCP-text seeks to undo this detrimental belief by enlisting professors from QBA and all the business majors (see Chart 2) to edit the sections of the CCP-text most germane to their course needs. These same non-IBES faculty also wrote 20 questions, with verbose solutions, which were inserted into the chapters, sections, or sub-sections of the CCP-text where appropriate. Each of these questions appears in the CCP-text with the corresponding major label affixed to it. For example, "P1.8 (Accounting)" indicates that problem 8 in chapter 1 was written by a professor in the accounting department. Moreover, IBES students are repeatedly reminded that the CCP-text questions were not written by just any accounting professor, but by the *actual* accounting professors that they will take classes from should they choose to become an accounting major in our COB. Implied by this, but also explicitly emphasized to IBES students, is that the CCP-text questions were not written by graduate students at some far-away university, but by local faculty members that interact with area businesses (e.g., via consulting), and that have the most direct interest in their students' success. This construction provides students with tangible examples of the statistical expectations of the faculty members that teach upper-level business and economics courses.

The interactions between the PI and the three secondary authors of the CCP-text (see left side of Chart 2) and these other non-IBES business professors resulted in some mutually beneficial professional development by learning how each major area uses statistics.[3] For example, area-specific nomenclature or notation was noted in the CCP-text to help avoid the perennial problem where students get confused because Professor A uses one set of terminology for a statistical method whereas Professor B uses a different set of terminology to exposit the same statistical method.

[3] Chart 2 lists a "Professor 4" but only three secondary authors are mentioned in the narrative. The fourth professor was the PI himself, who wrote professor-specific sections for his own version of the CCP-text.

To further smooth the transition from IBES upward, several particularly successful IBES students were hired to read, edit, and solve every problem in the CCP-text. Most of these students either were or became tutors for one of the business areas. This not only gave the CCP-text a "grass-roots" feel, but also created a series of tutors exceptionally well positioned to help students struggling with IBES. This component of the paradigm is depicted in Chart 2 as a line from the Upper-Level Students box to the PI. A publishing house, seeking to market an IBES text internationally, would have considerable difficulty mimicking these types of "grass roots" tactics.

3.2 Desideratum D2: Professor-Specific Control

A common complaint about rental texts is that they partially compromise professor-specific control over course content and structure (see, for example, the previously referenced Appalachian State Study). This can lead to uninspired teaching and frustrated students. To combat this, the CCP-text uses, as its name indicates, a core-concepts plus approach. What this means is that a core concepts text was written, that included all the topics taught by all IBES professors – the intersection of IBES statistical concepts. These core concepts precipitated from a series of interactions among the IBES faculty and interactions between the IBES faculty and the larger community of business faculty. The former occurred in a series of extended meetings, while the latter was guided by a formal survey put out to all COB faculty members to help ascertain their IBES topical coverage needs. Both of these activities were done in years prior to the grant window in an effort to prepare the COB for assurance of learning as dictated by the Association to Advance Collegiate Schools of Business (AACSB), the accrediting body for the COB. Thus, the core concepts for IBES had already been determined by a faculty-driven and AACSB-focused effort prior to the inception of the CCP-text idea. This piece of good fortune made it relatively easy to write the core-concepts text, which constitutes about 85-95% of the final CCP-text, depending on the professor. However, recent work by Woodard and McGowan (2012) regarding the determination of introductory statistics coverage would be a useful reference if a university seeking an IBES CCP-text had not yet settled on its core concepts.

The remaining 5-15% of a CCP-text's content was professor-specific material written by said professor to cover non-core material of particular interest to said professor. For example, some IBES professors wanted sections on the geometric and hypergeometric distribution whereas others did not, preferring instead to have additional sections on the geometric mean and the coefficient of variation. Others wanted extended discussions of the expectation and variance operators while some included interaction terms in the regression chapters, etc. It is because of this professor-specific flexibility in content that the plural term "CCP-texts" is used, where appropriate, throughout the paper. Specifically, there is one core-text, which is then augmented with these professor-specific additional sections to create a full IBES CCP-text for each particular professor. These professor-specific sections, when added to the core-concepts sections, permit each professor to apply their individual tastes and additions, giving them partial ownership of the CCP-text and the students a complete IBES experience.

It is important to note that these professor-specific sections were not simply tagged to the end of the core concepts text, but rather inserted throughout the core concepts text in the order and the exact locations desired by the specific professor. The software used to create the CCP-text, called

LaTeX (www.miktex.org), allowed the PI to produce professor-specific versions of the text by making only minor changes to a master file – a process requiring only minutes to produce each professor-specific version of the text. Moreover, the software re-numbers all the problems, tables, and figures, includes selected answers on a professor-specific basis, and creates a hyperlinked table of contents and glossary to exactly match each professor-specific version of the text. The software also permits each professor to have their own notation for their version of the CCP-text, if so desired. Hyperlinking the table of contents, glossary, figures, and tables enhances the students' ability to navigate the PDF version of the CCP-text. The links are reduced to plain text in the hard copy version, and accordingly function just like a traditional textbook. For example, the hard copy glossary looks and functions exactly as it would when using a traditional text. This was done to give students with strong "hard copy" preferences a familiar product. Efforts were taken to ensure that the hyperlinks, when printed in hard copy, did not cloud the hard copy version of the text. Specifically, all links to websites were written in full URL detail in the PDF, so students with a hard copy version would be able to type in the entire address.

This project could have been completed using more standard word processing software. However, LaTeX has several notable strengths. First, it is freely available. Second, it is heavily used in the math-based disciplines because it handles mathematical expressions commonly found in IBES more readily than standard software. This aspect is especially important when hundreds of mathematical equations appear over several hundred pages of text. Third, LaTeX source code creates and stores figures and tables as text, and as such the file size is extremely small. Even as a PDF, the entire CCP-text is only about 2 megabyes (unzipped). This compactness was an asset early in the project when student email capacity was quite limited. Fourth, products exist for converting PDF to XML, if needed or preferred, and LaTeX itself can be used to produce XML files directly.

The professor-specific sections proved very popular among the IBES professors. Accumulated discussions with each of them, as well as conversations with conference participants, revealed that professors appear to have strong opinions for or against an *entire* textbook based on how it treats *selected* topics over which the professor has particularly strong pedagogical opinions. Endowing the professor with the ability to adhere to the core concepts idea, but then also permitting professors to add sections – large and small – throughout the CCP-text eased much of the angst that would have otherwise precipitated had a single rental text been imposed on all IBES professors. In short, a large degree of commonality was preserved, hence inducing a more uniform or horizontally integrated IBES experience for students taught by different IBES professors. And, each professor was able to assert their professorial identity and specific statistical interests within the IBES course. Moreover, this was done "seamlessly" because of the software's wonderful ability to easily accommodate nearly every type of professor-specific desire. While a number of publishing houses now offer various e-text-like products, they cannot supply the degree of professor-specific control, updating, and real-time maintenance offered by the CCP paradigm.

3.3 Desideratum D3: Save Students Money

A core tenet of the project was to save students money by delivering a publisher-quality, externally reviewed textbook at little or no cost to students. While the CCP paradigm has several advantages over publishing-house textbooks – many of which parallel the desired properties discussed in Advisory Committee on Student Financial Assistance ACSFA (2007) – this section focuses on textbook costs savings.

It is well known that textbooks are a significant cost of post-secondary education. The Government Accountability Office GAO (2005) found the average price for textbooks in the 2003-2004 academic year to be roughly $900, or about 26% of tuition and fees for a typical four-year public university. The nominal price of textbooks has risen by more than twice the amount of inflation since 1986, largely due to the proliferation of "extras" such as CDs, Microsoft PowerPoint® slides, websites, etc. Publishers cite a demand for these extras, especially among adjunct professors. However, the controversial packaging practices of these extras with the textbook generally result in higher prices for all purchasers, and often negatively influence buy-back options for students.

Publishing houses have also increased the frequency at which they produce new editions (OORA 2007). This contributes to the students' textbook financial burden because it reduces buy-back options. This accelerated turnaround of textbook editions may be justifiable in some areas of study where current material is the core substance of the course, but in many areas of study, like introductory-level mathematics and statistics, substantial topical changes are unlikely to occur between editions.

Many textbooks are available in "international" versions at a lower price than a "domestic" version. This offers motivated and informed students a possible way to reduce textbook expenditures. However, the GAO (2005) notes the following:

> In response to concerns that the international availability of less expensive textbooks might negatively affect textbook sales, publishers have taken steps to limit large-scale textbook reimportation.

The specific types of actions taken to reduce large-scale reimportation are also noted:

> Specifically, publishers told us [the GAO] that they have strengthened their agreements with foreign wholesalers to prevent the large-scale sale of U.S. textbooks back to the United States. Some publishers also said they have made an agreement with an online retailer outside the United States to limit the number of copies of a given textbook that can be delivered to a single U.S. address in one order.

The GAO report also notes other pressures seeking to limit the international-edition option:

> Concerned about the effects of differential pricing on college stores, the National Association of College Stores has called on publishers to stop the practice of selling textbooks at lower prices outside the United States.

As noted in ACSFA (2007), textbook costs are problematic in that those that require the textbooks (the professors) do not have to shoulder the financial burden of their decision. Instead the consumers (the students) bear the cost with no say over the content, structure, or the price of the textbook. As ACSFA (2007) and Koch (2006) note, the rising cost of textbooks is especially taxing for students of modest means. Textbook costs clearly affects students, often inducing them to avoid purchasing textbooks unless absolutely necessary, which certainly has potential to contaminate the learning process. Buczynski (2007) describes the idea that some courses might be effectively taught by accessing information from various freely available online sources. He is optimistic about such a paradigm for selected courses; however, the economists will always remind us that "there is no free lunch."

One of the reasons IBES was specifically targeted for this project was the high cost of traditional statistics textbooks used by the IBES faculty prior to the development of the CCP-texts. These costs ranged from $110-$200+ depending on how the professor wanted the text packaged.

Having the CCP-text freely available to IBES students during three semesters of the project, a total of approximately $150,000 was saved in new textbook costs (this estimate uses 2011 prices averaged across several vendors). Had all students been able to obtain a used version of the text, the total savings would have been about 75% of that figure (OORA 2007). By the sixth semester of use, student savings on textbook expenditures will surpass the *total* FIPSE grant award that supported the CCP project.

3.4 Desideratum D4: Improve Student Learning Experiences and Outcomes

The student learning experience with the course materials was gauged using a student satisfaction survey. Some questions were open ended, but most were Likert-scaled. Here are the results from the two main open-ended questions from the survey:

- *What are the biggest strengths of having and using CCP-texts?* Cost (48%); Easy to access (23%); Able to search them (16%); Less weight to carry (9%); Other (4%).
- *What are the biggest challenges of having and using CCP-texts?* Reading from a computer screen (38%); Need a computer to access (26%); None (15%); Can't highlight/write notes in book (8%); Getting used to it (6%); Distractions when on the computer (3%); Other (4%).

Here are the results from several of the central indicator and Likert-scaled questions:

- *Do you like the idea of CCP-texts*? Yes (97%); No (3%)
- *Do you think using CCP-texts in school would save money*? Yes (98%); No (2%).
- *CCP-texts are as good as print books.* Strongly Agree (53%); Agree (34%); Disagree (8%); Strongly Disagree (3%); NA (2%).

- *The bookstore should provide book titles in both print and e-text format.* Strongly Agree (53%); Agree (39%); Disagree (4%); Strongly Disagree (1%); NA (3%).

These results are somewhat inconsistent with the literature summarized in earlier sections, which generally found student dissatisfaction with e-texts. For example, Shepperd, Grace, and Kock (2008) found that while student performance was not significantly different across modes of textbook (e-text or traditional), student opinions of the e-text were generally unfavorable. Here, in contrast, students with CCP-text experience spoke very favorably of the CCP-text and considered them to be as good as printed books. Note also that the CCP paradigm tenet wherein a PDF and hard copy are both feasible was very attractive to students. And, needless to say, the near-zero cost was very popular among students.

Pre- and post-tests were used to evaluate student learning when using the CCP-texts during the three semesters of the grant window. The assessment results for all three semesters were very similar. The assessment testing paradigm was put in place several years prior to the project in response to pre-existing AACSB assessment requirements. This permitted a before-and-after project comparison. The CCP-text was first used in fall 2010 and remains in use through the present.

The pre- and post-test exams themselves were identical, consisting of the same 20 questions agreed upon as covering the core areas of aptitude most germane to the IBES course and AACBS expectations. In every semester, the pre-test was available on the assessment site for the first ten days of class, and the post-test was available for the last week of class. Only those students that completed both the pre- and post-tests were included in the analysis for the simple reason that, absent both of the scores, it was impossible to compute the difference (improvement) between the pre- and post-test scores. While the assessment tests were optional, the average participation rate was high, around 80%. Professors in each IBES section offered some form of extra credit structured in a way that encouraged participation and earnest performance on both the pre- and post-tests.

Professors volunteered to use either the CCP-text for their entire class or a traditional text. In the first assessment semester, fall 2010, two of the IBES instructors used the CCP-text and two did not. In all subsequent semesters, all IBES professors voluntarily chose to use the CCP-text.

The following two questions were used to guide the learning assessment analysis component of the final report submitted to FIPSE:

- *Q1: How do aggregate pre- and post-test results from semesters prior to the e-text compare to aggregate pre- and post-results from semesters when the CCP-texts were used?*
- *Q2: Do students taught by the same professor across different semesters learn more when using the CCP-texts versus a traditional textbook?*

Summary answers to these questions are as follows:

- *Summary Answer to Q1:* The differences (improvement) between pre- and post-test scores between years where the e-text was used and when it was not used were compared.

In all of these comparisons, the amount of learning, measured by the amount of improvement between pre- and post-tests scores, was statistically significantly higher during the semesters where the CCP-texts were used.

- *Summary Answer to Q2:* Only two of the professors had section-level pre- and post-test results from before and after implementing the CCP-texts, permitting a natural experiment that controls for professor. For one of these professors, assessment results were not statistically different (t-statistic = 0.51); for the other professor the assessment results were statistically significantly higher (t-statistic = 3.42) when using the CCP-text.

Taken together these results suggest that student learning was at least as good and in some cases better when using the CCP-texts. This is encouraging, given that most prior studies found no difference in learning outcomes when comparing e-texts to traditional texts (e.g., Murray and Pérez 2011).

It may be worth noting that these results were obtained using early "beta" versions of the CCP-texts. As the CCP-texts get further refined, and as professors get more accustomed to teaching with them, it is reasonable to conclude that the impact on student learning will become more pronounced.

There is another layer of possible student learning improvement that, unfortunately, could not be captured by the existing assessment structure. Specifically, it would be of interest to know if implementing the vertical integration (D1) desideratum improved student preparedness and performance in subsequent mid- and upper-level courses. Such a mechanism would be a useful addition if another university should seek to emulate the CCP paradigm. However, the short (2-year) grant window was not long enough to capture the necessary longitudinal data for such an analysis.

3.5 Desideratum D5: Create a Disseminable Paradigm

The CCP paradigm can be propagated in several ways. First, other universities could directly mimic the IBES template outlined in this paper and create their own in-house authored IBES CCP-texts. Second, the CCP-texts construction is not limited to IBES. Courses like Business Calculus, for example, could likewise benefit if a mathematics department adopted the template. (In fact, four math professors at the author's university have already begun applying the CCP-text paradigm to their finite mathematics course, and have plans to do so for a second lower-division, high-enrollment math course.) Third, the actual IBES CCP-text created in this project could be made available to universities, which they could modify as needed.

Implementing the CCP paradigm does require funding, as it is a labor intensive undertaking. A grant from the US Department of Education (FIPSE component) supported this project. This permitted all contributors and external reviewers to be compensated for their time and effort. Funds to support a replication of this project may be available through various granting agencies or perhaps through university-level initiatives. The grant award for this project included stipends for student contributions and pay plus fringe for faculty contributors. External reviewers were also hired and paid, and FIPSE required an external grant evaluator, who received roughly 10% of the award. The university and college also retained a percentage of the award. The grant paid the PI for two summers and also funded a partial course release in the semesters when the CCP-

text was first used. As noted earlier, the mathematics department has begun a similar project for two of their math courses; they also received funding from the grant. Approximately 30 faculty and students participated in the project. It is worth emphasizing that the CCP-texts, now in their sixth semester of use, have now saved students more than the amount of the grant award. Thus, the CCP paradigm may be a good investment over all. An earnest and energetic PI is essential to successfully coordinate the many contributions that are ultimately combined to create the CCP-texts. While any number of word processing software products may be able complete the associated tasks, the power, flexibility, and elegance of LaTeX is impressive.

The CCP paradigm is best suited to large enrollment introductory-level courses where the course content is relatively constant across textbook editions. Introductory-level courses in statistics, economics, and mathematics are sensible venues for future CCP-text applications, though other non-quantitative disciplines (e.g., English or History) might also find the paradigm useful.

4. Conclusions

The CCP paradigm has most if not all of the benefits of a traditional textbook rental program without many of the difficulties. The CCP paradigm has additional properties valuable to improving the financial, educational, and professional prospects for students. A paradigm that meets all five desiderata (D1-D5) with a single, low-cost construction constitutes a possible blueprint for alternative textbooks and a partial solution to the textbook cost problem.

Fixing errata and other small-scale maintenance is conducted between semesters by the PI. This is easily managed using LaTeX. For more substantial changes to the CCP-texts, the author's campus has a large Faculty Development Program containing several components, among them a teaching component. Faculty members can submit grants for up to 15% of base salary as summer support to engage in teaching-related professional development activities. This, along with department and college funds, offers plenty of possible funding sources to help keep the CCP-texts up to date. Professor-specific materials are often updated by each professor of their own volition, usually during the summer. The PI folds the materials into the newest edition of the CCP-text for that professor's fall classes.

The creation and maintenance of the CCP-texts is greatly facilitated by the use of the word processing language LaTeX. This is not to suggest that other word processing language could not accomplish the task, but the ease and elegance with which professor-specific versions (including professor-specific notation, glossaries, selected answers, etc.) can be assembled makes LaTeX a very attractive tool for implementing the CCP paradigm. It is relatively easy to learn and offers the user incredible control when managing large documents, especially documents with numerous complicated mathematical equations.

The CCP paradigm champions the notion of delivering to students a high-quality, low cost (actually free in PDF format) IBES textbook with some of the flexibilities of an e-text and the ability to be produced in hard copy with no meaningful loss in efficacy. It spans many existing good ideas from the past and present textbook arenas, serving as an improvement upon and amalgamation thereof. Concurrent efforts to find similar campus-wide ways to embrace e-texts

and save students money are being explored (e.g., Graydon, Urbach-Buholz, and Kohen 2011), and hopefully more efforts will be undertaken.

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