New Orleans JAZZED about Engineering Education

Paper ID #14712

A Design-Based Research Approach to Refining Pedagogy in Engineering Economics Online Learning

Ms. Kellie Grasman, Missouri University of Science & Technology

Kellie Grasman serves as an instructor in Engineering Management and Systems Engineering at Missouri University of Science and Technology. She holds graduate degrees in engineering and business administration from the University of Michigan, and began teaching in 2001 after spending several years in industry positions. She was named the 2011-2012 Robert B. Koplar Professor of Engineering Management for her achievements in online learning. She serves as an eMentor for the University of Missouri System and earned a Faculty Achievement Award for teaching.

Dr. Dan Cernusca, North Dakota State University

Dr. Dan Cernusca is an Assistant Professor of Practice/ Instructional Designer with the North Dakota State University, College of Health Professions. He received his Ph.D. degree in Information Science and Learning Technologies in 2007 from University of Missouri – Columbia. He also holds a BS and a Ph.D. from the University of Sibiu in Romania with a specialization in manufacturing technologies and respectively cutting-tools design. His research interests include design-based research in technology-enabled learning contexts, technology-mediated problem solving, applications of dynamic modeling for learning of complex topics, and the impact of epistemic beliefs on learning with technology.

A Design-Based Research Approach to Refining Pedagogy In Engineering Economics Online Learning

Introduction

With the implementation of technology in education, educators accept responsibly for ensuring new approaches and tools add value to students' learning. In this study, we continue to follow a series of design-based research macrocycles[1,2] to monitor the impact of specific technology solutions implemented in a large Engineering Economics course and their perceived usefulness and value to students. Baseline findings indicated that value and usefulness of Reading assignments, the primary source of content in the digital text, was limited. Since then modifications to both the course assessment structure for reading assignments and digital text itself were implemented.

This paper presents research findings from an online approach to instruction deployed in a large Engineering Economics course. The course offered students a choice of learning resources including online resources, optional classroom activities, and multiple support resources. While a variety of resources were offered, about 90% of students chose to forgo the "in person" options and interacted solely with the online content. Consequently, the value and usefulness of online content is of primary significance. The online content consisted of resources in a learning management system as well as a subject-specific online learning environment, *WileyPLUS.* A previous study focused on the students' perceived usefulness, value, and overall impact on their learning of the *WileyPLUS* tools and their predictive power on students' overall course performance. This previous research highlighted that the value and usefulness measures associated with *WileyPLUS readings* were not statistically significant predictors of perceived impact. To address these findings, major enhancements to the reading tools were implemented, and associated impact on usage and value were quantified. Further, as student preferences trend away from student - teacher interaction in favor of increased student - content interaction in the online environment, profiles of usage and value of the buffet of tools were analyzed.

Motivation of the Study

Encouraged by increasing student enrollment and enabled by advances in learning technologies, a large Engineering Economics course was redesigned in a hybrid/buffet mode to incorporate the positive aspects of both online and face-to-face elements. The hybrid/buffet mode combines two significant pedagogical strategies. First, as a "hybrid" course, a portion of the activities that would normally take place in the classroom were shifted to an online format. Hybrid course delivery (also commonly referred to as *blended learning*[3]) reduces demand for university classroom space and promises accessible, cost-effective, efficient, standardized instruction, especially for high enrollment courses. From the student perspective, hybrid delivery has the potential to increase scheduling flexibility while maintaining some face-to-face interactions with faculty and fellow classmates. Second, the "buffet" model, as described by Carol Twigg of the National Center for Academic Transformation[4] allowed for a customizable environment, enabling students to choose their preferred approach to the course from a buffet of learning options.

Beginning as a pilot section offered in Spring 2011, the hybrid/buffet delivery of a large enrollment Engineering Economics course (600+ students per year) has experienced incremental evolution over 15 semesters (Fall/Spring/Summer each year). Quantitative measures like student success rates, performance on key learning objectives, and student perceptions of online content, measured through formal research studies, have informed a refined and stable course design[5]. Further, qualitative measures like survey comments, student focus groups, and instructor observations have facilitated the fine-tuning of more subtle, yet equally important, aspects of the course like tone of communication and website usability.

After semesters of iterative refinement, the course itself has changed as well as the attitudes of the students. The hybrid/buffet course design has enabled a palpable shift in student accountability, away from a passive receiver of content (as may be experienced in a traditional lecture environment) to an active, individually accountable learner. Students are presented with a wide variety of tools to access content and practice skills, complemented with a wealth of on-demand online and "human" support. Instructional design strategies and resources will be discussed in more detail further in this paper. Most students accepted the message that they can be successful and will receive the help they need to do so. A general shift in the attitudes about classroom seat time has also occurred, possibly due in part to the course design. Since the pilot offering, the percentage of enrolled students electing to attend live classroom sessions has progressively decreased. The reasons for this shift are likely numerous and complex, but the end result is that an overwhelming majority of students access the course in an exclusively online mode.

Given the generally well-refined overall instructional design, focus has shifted to enhancing specific aspects of course delivery. With the shift away from seat time, students were increasingly more dependent on the online course resources for content delivery, interaction, assessment, progress monitoring, and so on. Consequently, refinement of these online resources has become the primary focus. For example, efforts to incorporate universal design principles in online site layout to increase accessibility and usability are underway. Adoption of online performance tracking and early alert systems are implemented to identify and support at risk students. The refinement of digital resources for content delivery and assessment are of primary interest.

A previous study[5] on this course highlighted limitations of the course online Reading resources, and informed possible changes to this content and related assessment design. This paper presents a summary of current delivery methods and analysis of the impact of design changes related to Readings. Further, student value and usage of course resources are profiled to identify key components.

Course Design Strategies

An undergraduate Engineering Economics course has evolved over successive semesters, informed by design-based research strategies[1,2]. This study compares measures from two sample semesters, Fall 2013 and Fall 2015. For each of these two semesters two large sections were delivered in a hybrid/buffet mode, though significant modifications to online content occurred from Fall 2013 to Fall 2015. A thorough discussion of the historic course structure, components,

and preliminary implementation results may be found in a recent journal paper.[5] A summary of Fall 2013 course components is presented here, followed by a description of modifications implemented for Fall 2015.

Fall 2013 Instructional Design Strategies

The Fall 2013 course components may be categorized as:

1. Online Resources
    a. *WileyPLUS*, the online learning environment associated with *Principles of Engineering Economic Analysis 5e* by White, Case and Pratt[6], consisting of a digital copy of the text as well as ungraded Reading and graded Practice Problem assignments.
    b. Instructor-Created Modules, consisting of Introduction videos with learning objectives, Lessons in both PowerPoint™ and video form, and Example problem videos contained in the learning management system.
2. Classroom Activities
    a. Lessons, consisting of PowerPoint™ presentations with live annotation
    b. In-Class Problem Solving with polling, consisting of examples solved by students and/or the instructor with audience response
3. Support Resources
    a. Problem Solving Help, consisting of tutoring three afternoons per week by skilled undergraduate Learning Assistants in a computer lab setting
    b. Piazza, an online question and answer platform allowing shared access to answers to common questions

As in past semesters, Fall 2013 students were encouraged to access the resources that they found most useful to them as individual learners. Students could choose to participate in the Classroom Activities and/or access the Online Resources to review material independently. Students were free to change their mode of participation throughout the semester, though a significant majority (~90% of enrolled students, as measured by classroom attendance) elected to access Online Resources exclusively with no classroom participation. This preference for online has evolved over successive offerings, with only 44% of students choosing to utilize exclusively online resources in Fall 2011[5]. Consequently, though the course may still be categorized as a hybrid/buffet offering, a significant majority of students approached the class as an exclusively "online" offering.

Regardless of their approach to access content, all Fall 2013 students were assessed in the same manner. Course grades were determined by performance on two proctored pencil and paper exams (50% of overall grade), four online quizzes completed in WileyPLUS (25% of overall grade), and weekly practice Problem assignments completed in *WileyPLUS* (25% of overall grade). Weekly, ungraded Reading assignments were also available in *WileyPLUS*.

As noted, a significant majority of students chose to interact *exclusively* with online resources, and these circumstances encouraged further analysis of the resources in this area. The two primary online resources were *WileyPLUS* and Instructor-Created Modules respectively. The

WileyPLUS online resource was the primary focus of a previous study[5], and analysis continues in this paper.

The required Fall 2013 textbook, *Principles of Engineering Economic Analysis 5e* by White, Case and Pratt[6], was available to students in hardcover and digital form. All students were required to purchase access to the corresponding *WileyPLUS* site, which offered a full digital version of the textbook as well as assessment tools.

The ungraded *Reading* and graded *Practice Problem* assignments mentioned above were located in *WileyPLUS*. The *Reading* component was comprised of specific text sections assigned from the digital textbook. Each assignment linked students directly to the digital text, which appeared almost identical to that of the print text. *Practice Problem* assignments in *WileyPLUS* generally included 8-10 or more problems chosen from the end-of-chapter questions in the text or created by the instructor, and student performance on the assignments constituted 25% of the overall course grade.

Fall 2015 Instructional Design Strategies

As motivated by previous design-based research[1], summarized in greater detail in the next section, modifications to the instructional design were implemented for the Fall 2015 semester. Since the course has undergone regular refinements over the course of five years, the majority of course components have proven effective and remained constant for Fall 2015. However, several significant modifications were implemented for Fall 2015. The primary modifications may be categorized as changes to assessment structure and digital resources.

Specifically, the assessment components comprising overall student course grade were modified to include a weekly graded Reading Review assignment. Fall 2015 course grades were determined by performance on two proctored pencil and paper exams (50% of overall grade), four online quizzes completed in WileyPLUS (20% of overall grade), weekly Practice Problem assignments completed in *WileyPLUS* (25% of overall grade), and newly-created weekly Reading Review assignments completed in WileyPLUS (5% of overall grade). Weekly Reading assignments continued, but were not part of overall course grade.

The added weekly graded Reading Review assignments consisted of approximately 8-10 multiple-choice questions carefully chosen to assess basic comprehension of concepts introduced in the ungraded weekly Reading assignments. Typical Reading Review questions involved activities such as matching a term to the appropriate definition, identifying the correct form of an equation, confirming the validity of a statement (true or false), or choosing the correct word to complete a statement. Students were allowed two attempts to arrive at the correct answer, with no penalty for an initial incorrect answer (i.e. students received full credit if they submitted the correct answer within two attempts). Because the main goal of this assessment was a formative one, all Reading Review questions included a link to the associated section of the digital textbook. The link guided students to review relevant text material before answering the question.

Additionally, the digital resources contained in WileyPLUS were enhanced to include interactive resources beyond the former static digital textual content. Resource enhancements included hyperlink *key terms*, *video lessons*, and *video examples*. *Key terms* within paragraphs of the digital text were highlighted in blue, and clicking on the blue term displayed a definition of the term in a popup window. Though not linked directly to their Reading assignments, students also had the option to work independently with digital flashcards of key terms and quizzing of definitions & terms.

Video lessons appeared as a link at the beginning of most text sections, presenting a brief mini-lecture covering the topics of that text section. The *video lessons* displayed like a presentation with audio narration and dynamic annotation of slides as the video progresses. A typical lesson might include an introduction of concepts & terminology, presentation of related equations and a numeric problem solved by hand. Students had the option to pause, skip, and replay the lessons as desired.

Finally, *video examples* were linked to select text example problems. The example problem was presented in static text form on the screen, and clicking a link opened a video detailing the solution process. *Video examples* demonstrated the solution process with audio narration and often included multiple solution approaches. For instance, one example problem might be solved "by hand" with text writing and equations as well as in Excel with a recording of the creation of the software solution displayed.

It is important to note that a subset of the *video lessons* and *video examples* incorporated in the WileyPLUS environment were previously available to students within Blackboard, the course learning management system (LMS). While students were directed to view these video lessons and video examples in the LMS, they were not part of graded assignments nor contained in the environment were students completed graded assignments.

The modifications for Fall 2015 were made possible by a shift to a new text, White, Grasman, Case, LaScola Needy, and Pratt's *Fundamentals of Engineering Economic Analysis 1e*[7]. The new text maintained the same fundamental coverage and structure of the previous text, but included the enhanced interactive digital text resources noted above as well as additional question banks to allow for Reading Review assignments. Minor adaptations to the appearance of the digital text, implemented to enhance usability, were also included in the new title and some advanced topics (not included in the coverage of this course) were abbreviated or omitted. However, the fundamental presentation of content relevant to this course remained consistent in spite of the new title.

Research Goals

The course design incorporates numerous activities and resources, and encourages students to choose the path that best complements their preferences and learning style. Consequently, the course design and progressive refinements may be analyzed from an innumerable variety of perspectives and approaches. In this paper, we focus our analysis on specific course components as informed by previous research.[5] An earlier analysis indicated that value and usefulness measures associated with the ungraded WileyPLUS Readings were not statistically

significant predictors of perceived impact or student success in the course. In an attempt to improve impact of Readings, specific modifications were implemented from Fall 2013 to Fall 2015. Further, motivated by the increase in student-content interaction, and consequent decrease in student-teacher interaction, an exploration of student utilization and value preferences related to online course resources is pursued.

In this study we focused on two major goals related to students' perceptions and utilization of course resources as follows:

1) To quantify the impact on students' utilization and perceived value of digital Readings with the implementation of changes to the related assessment structure and digital text resources, and
2) To measure the impact of the addition of a graded Reading Review on students' utilization profile and value of the buffet of course components offered

Research Methodology

Research Design

We used a quantitative survey design to address the two foci of this research study. The proposed design allowed us to: (1) identify the relationship between the perceived value and usefulness of the two student cohorts that participated in the baseline (Fall 2013) and enhanced (Fall 2015) course design, and (2) further expand the analysis of students' perceptions in the enhanced course design.

Participants

For the Fall 2013 cohort, out of 264 students enrolled in the course, 101 (38 %) participated and provided a full input for all variables considered in this study. For the Fall 2015 cohort, out of 313 students enrolled, 250 (80%) provided a full input for this study. The increased response for Fall 2015 is likely the result of timing of distribution of the survey. Distribution near the end of the semester, but *before* the final two weeks, resulted in significantly higher response rates.

Research Procedure and Instruments

We collected students' perceptions with an online survey administered at the end of the Fall 2013 and Fall 2015 semesters using Qualtrics™, a tool that allowed the instructor to send individual invitations to each student and reminders to only those students that did not participate in the survey by a given time. Students' participation was voluntary and rewarded with bonus points that were stimulating but did not have a significant impact on students' final score in the course.

The survey questions used in this study are presented in Appendix. As shown in the Appendix, we grouped the component usage and perceived value in one type of question with a 6-point evaluation scale. These questions' evaluation scale had 1 for asking if the component was not

used and a 5-point ranging from 2 – not at all valuable to 6 – very valuable. For the analysis phase this variable was converted in two variables, one for the usage (0-not used, 1 used) and one for the perceived value (1-not at all valuable to 6-very valuable).

To measure the perceived usefulness we used a 5-point scale, ranging from 1- very useless to 5 – very useful. The usefulness question for each component was assigned only to those students that indicated they used the tool (a value of 2 or more in the usage-value question described above).

Results and Discussion

Comparing Fall 2013 and Fall 2015 course implementations

As mentioned in the course design part, from Fall 2013 to Fall 2015 implementation of the target Engineering Economics course one of the major changes was the inclusion of a Reading Review assessment to enhance students' perceived value of assigned readings. In addition, for the Fall 2015 cohort the online environment associated with the new digital textbook integrated the Lessons and Examples that previously were offered as complementary material through the course's LMS. The goal of these changes was to increase both the usage of these components and their perceived value and usefulness. Table 1 below shows the changes in usage and the associated perceived values and usefulness of each target component for the two course implementations.

Table 1

	Fall 2013 (N =101)			Fall 2015 (N=250)		
Course Component	**Usage [%]**	**Value (SD)**	**Usefulness (SD)**	**Usage [%]**	**Value (SD)**	**Usefulness (SD)**
Readings	86.1	3.06 (1.08)	2.77 (.95)	96.4	3.63 (1.01)	3.66 (1.0)
Practice problems	91.1	3.98 (.89)	1.66 (.79)	99.2	4.27 (.77)	4.34 (.84)
Lessons	94.1	4.16 (.76)	1.87 (.84)	90.0	3.98 (.98)	3.93 (.92)
Examples	95.0	4.23 (.77)	1.67 (.79)	93.2	4.22 (.87)	4.23 (.80)

Impact on Usage

Due to the nature of usage data, categorical data, we used a chi-square analysis to test if there were significant changes for the component usage for the two semesters. The chi-square analysis showed that the number of students in FS15 semester that indicated they used Readings (96.4%) was statistically significant higher than FS13 students that indicated they used Readings (86.1%), χ^2 (1, N-351) = 12.4, $p < .0001$. Similarly, the chi-square analysis showed that the number of students in FS15 semester that indicated they used Practice problems (99.2%) was statistically significant higher than FS13 students that indicated they used Practice problems (91.1%), χ^2 (1, N=351) = 15.6, $p < .0001$. While there were small changes in the usage for the other two components, Lessons and Examples, chi-square analyses found no statistically significant changes for these values.

Impact on Perceived Value

For the perceived value of each component, we used an independent-samples t-Test to analyze the impact of changes made in the course design. The independent-samples t-Test indicated that perceived value of Readings for FS15 students (3.63, SD=1.01) was statistically significant higher than the perceived value of Readings for FS13 students (3.06, SD=1.08), $t(326) = -4.37$, $p < .0001$. Similarly, the t-Test indicated that perceived value of Practice problems for FS15 students (4.27, SD=.77) was statistically significant higher than the perceived value of Practice problems for FS13 students (3.98, SD=.89), $t(338) = -2.93$, $p < .01$. As with the usage results, there were small changes in the value for the other two components, Lessons and Examples, but the t-Test analyses indicated no statistically significant changes for their mean perceived values.

Impact on Perceived Usefulness

As with the perceived value, for the perceived usefulness of each component we used an independent-samples t-Test to analyze the impact of changes made in the course design. The independent-samples t-Test indicated that perceived usefulness of Readings for FS15 students (3.66, SD=1.01) was statistically significant higher than the perceived usefulness of Readings for FS13 students (2.77, SD=.95), $t(324) = -7.18$, $p < .0001$. Similarly, the t-Test indicated that perceived value of Practice problems for FS15 students (4.34, SD=.84) was statistically significant higher than the perceived value of Practice problems for FS13 students (1.66, SD=.79), $t(338) = -26.59$, $p < .0001$.

Similarly, compared to use and perceived values analyzed above, the impact of the changes in Lessons and Examples components produced a significant positive impact on students' perceived usefulness. The independent-samples t-Test indicated that perceived usefulness of Lessons for FS15 students (3.93, SD=.92) was statistically significant higher than the perceived usefulness of Lessons for FS13 students (1.87, SD=.84), $t(318) = -18.75$, $p < .0001$. Similarly, the t-Test indicated that perceived usefulness of Examples for FS15 students (4.23, SD=.80) was statistically significant higher than the perceived value of Examples for FS13 students (1.67, SD=.79), $t(326) = -26.41$, $p < .0001$.

Overall Analysis of Student Perceptions for Fall 2015 Course Implementation

The previous analysis showed that the changes made in the course design had a significant positive impact on students' usage and perceived value of Readings and Practice problems components. As Figure 1 shows, usage rates for Readings, Practice problems, Examples and Lessons were in Fall 2015 at 90% or higher. Figure 1 also shows that Reading Reviews had the highest usage rate, which is to be expected since this component was set up as an assignment.

Further, we analyzed the relationship between the usage and perceived value of main course components. Figure 2 below combines the perceived value and usage, with the value being converted in percentages of the maximum perceived value of this scale (5.0). The plots were organized by the perceived value, from the highest to the lowest perceived values to show the relationship between the perceived value and usage.

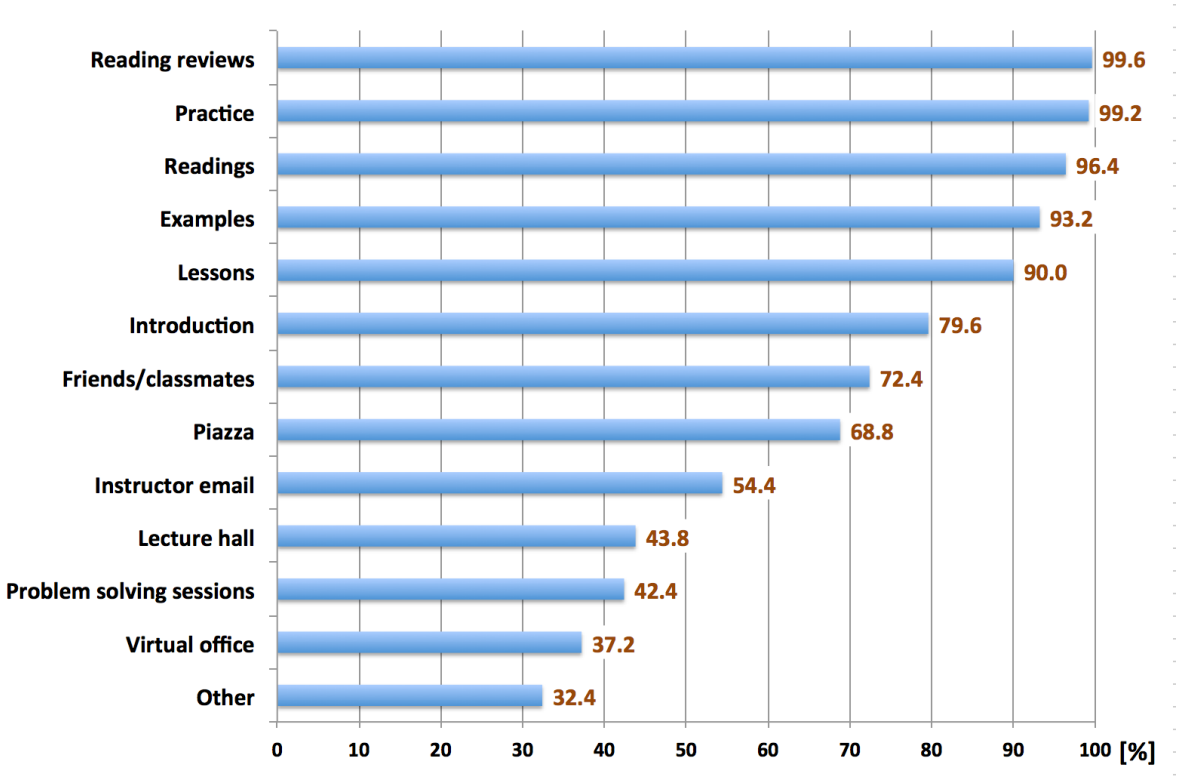

Figure 1. Students' self-reported usage of major course components – Fall 2015

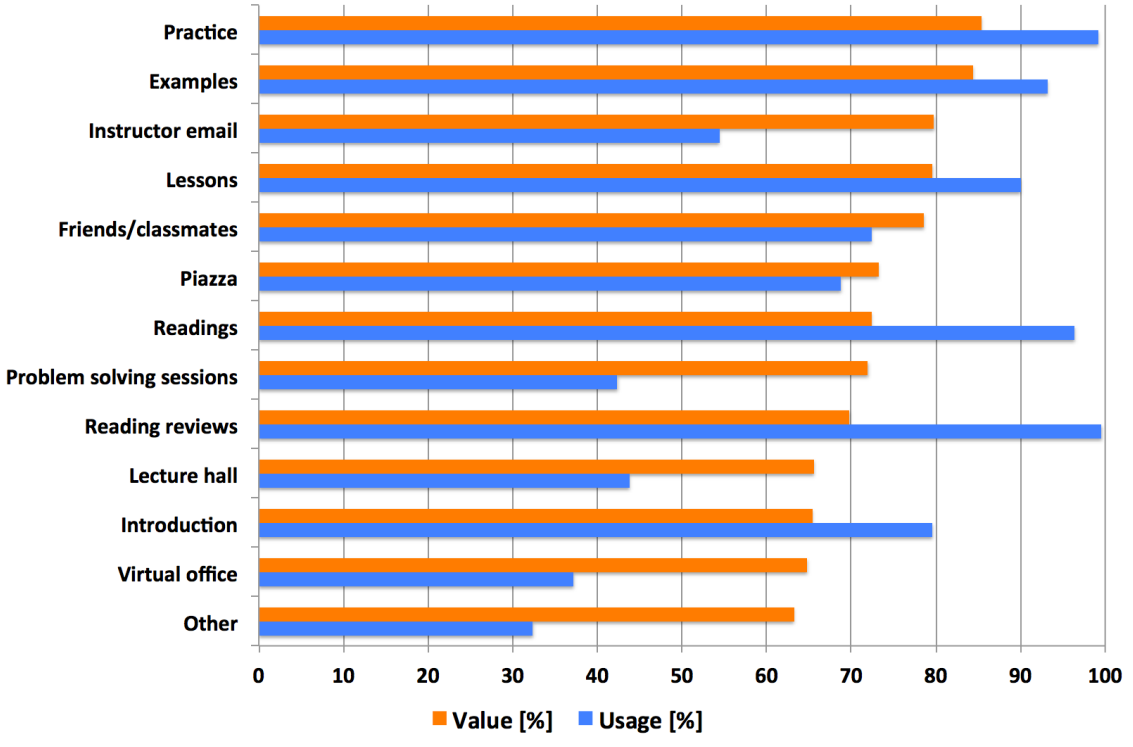

Figure 2. Relationship between students' perceived value and usage for major components – Fall 2015

As shown in Figure 2, Practice Problems remain the most used and valuable component of the course. This can be explained by the fact that quizzes and tests administered in the course are similar to Practice, so solving problems is core to the course. However, some components such as Readings and Reading Reviews had a very high usage rate but their perceived value was smaller than the perceived value of Practice, Examples and Lessons. One possible explanation for this behavior might be that Practice and Reading Reviews component were graded, and consequently highly utilized. Since, as shown in the previous section, the introduction of Reading Review assignments proved to increase significantly the perceived value of both Readings and Practice Problems, we analyzed if there is a positive significant correlation between these components (Table 2).

Table 2

Component	**Mean**	**SD**	**1**	**2**	**3**
1. Practice Problems	4.27	.77	1		
2. Readings	3.62	1.01	.10	1	
3. Reading Reviews	3.49	.96	.27**	.48**	1

** $p < .0001$

As shown in Table 2, the perceived value of newly included Reading Review assignments had a medium to high statistically significant correlation with Readings' perceived value, as expected. In addition, Reading Review had a weak but statistically significant positive correlation with perceived values of Practice Problems, showing therefore a transfer of positive impact to higher valued components.

Furthermore, the results summarized in Figure 2 indicate that since there is no physical presence for online students, instructor email is of high value. That is, students appreciated accessibility as well as the rapid response time. Another finding is that Examples and Lessons were high usage, high value components for Fall 2015 students. This suggests that students in the course seem to prefer the video content to the textual elements. Finally, students indicated both a high perceived value and high use of Classmates (in person or online) as well as the Piazza discussion forum. Consequently, instructors must assume students work together and assess accordingly.

Conclusions and Future Research

Through structured monitoring of the course design using a design-based research framework, targeted course enhancements have led to statistically significant improvements in usage and value for major course components such as Readings. However, it remains that while the students may be incentivized to read the text, they may not find great value in the exercise. A generalization of all data indicates that students prefer video content and active problem-related activities to text. Informed by this observation, future iterations of course design enhancements can focus on elements of highest value to students.

Further, the integration of instructional materials in a coherent online environment significantly increased students' perceived usefulness of components such as Lessons and Examples. Prior to Fall 2015, these video elements were available to students but were housed in the learning management system only. Integration of the videos in WileyPLUS, as a direct link within the presentation of textual content, is an incremental step toward a fully integrated active learning environment.

As observed in the evolution of content in massively open online courses (MOOCs), modular delivery of content (textual and/or video) with *embedded active learning* is expanding. Future course design enhancements may involve the addition of active learning elements directly in the digital text. As currently structured, content delivery – both text and video – is integrated in an interactive digital text but students remain passive receivers of content. Presently, all truly *active* elements (Practice problems and Reading Reviews) are separate assignments that may link to text but are likely pursued by students separately from the content delivery. Future enhancements may incorporate quizzing of terms and concepts directly within the content presentation – within the WileyPLUS digital text. Further, active problem-solving activities integrated within the interactive text could present on-demand concept practice with immediate feedback, support, and problem solving guidance.

With additional active learning embedded within the content, assessment structure may be modified. Low-stakes, frequent formative assessment integrated within the digital content could be encouraged by a small grade incentive. At this stage, collaboration may be encouraged, as we know students work together in the online course. However, given the known collaboration, higher stakes summative assessments (quizzes and/or tests) may remain proctored or developed from a pool of algorithmic questions to encourage independent responses. Continued monitoring of small incremental changes, as well as the proposed significant imbedded active learning additions, will inform future direction of course design and research.

References

1. Cernusca, D. & Ionas, I.G. (2014). Design-Based Research as a Form of Action Research. In: J. W. Willis & C. Edwards (Eds.), *Action Research. Models, Methods, and Examples* (pp.195-220). Charlotte, NC: Information Age Publishing, Inc.
2. Jonassen, D. H., Cernusca, D., & Ionas, G. I. (2007). Constructivism and Instructional Design: The Emergence of the Learning Sciences and Design Research. In R. A. Reiser & J. A. Dempsey (Eds.), *Trends and Issues in Instructional Design and Technology* (2nd ed., pp.45-52). Upper Saddle River, NJ: Merrill/Prentice Hall.
3. Sloan Consortium, "Blending In: The Extent and Promise of Blended Education in the United States", Needham, MA, 2007.
4. Twigg, C.A., "Improving Learning and Reducing Costs: New Models for Online Learning." *EDUCAUSE Review* Sep./Oct. 2003: 28-38.
5. Grasman, K., Cernusca, D. "Strategies to Enhance Learning in a Large Engineering Economics Course: Including Students' Perceived Values in the Instructional Redesign Process." *Journal of Online Engineering Education* 6.1 (2015). Available online at: http://www.onlineengineeringeducation.com/joee_v6n1a2.pdf
6. White, J.A., Case, K.E., and Pratt, D.B. *Principles of Engineering Economic Analysis 5e.* Wiley, New York, NY, 2009.
7. White, Grasman, Case, LaScola Needy, and Pratt. *Fundamentals of Engineering Economic Analysis 1e*. Wiley, New York, NY, 2014.

APPENDIX

Usage and Perceived Value - Sample Questions

For each of the following components that you used in the course, indicate its value to you. If you did not use it, indicate that.

	Did not use this	Not at all valuable	Not valuable	It was nice to have it	Valuable	Very valuable
Module "Introduction" (instructor videos)	o	o	o	o	o	o
Module "Reading" (text readings in WP)	o	o	o	o	o	o
Module "Reading Review" (mc questions in WP)	o	o	o	o	o	o
Module "Lessons" (instructor videos)	o	o	o	o	o	o
Module "Examples" (solved problems videos)	o	o	o	o	o	o
Module "Practice" (problems in WP)	o	o	o	o	o	o
Friends and/or classmates	o	o	o	o	o	o
Instructor response to email questions	o	o	o	o	o	o

Perceived Usefulness - Sample Questions

Overall, rate the usefulness of the Reading assignments in WileyPLUS to your learning.

- o Very Useless
- o Useless
- o Neutral
- o Useful
- o Very Useful

Overall, rate the usefulness of the Reading Review (weekly graded multiple-choice questions) assignments in WileyPLUS to your learning.

- o Very Useless
- o Useless
- o Neutral
- o Useful
- o Very Useful

Overall, rate the usefulness of the Practice problems (weekly graded problem assignments in WileyPLUS) to your learning.

- o Very Useless
- o Useless
- o Neutral
- o Useful
- o Very Useful