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Simplifying a Course to Reduce Student Stress so Students Can Focus Again on Learning

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Simplifying a Course to Reduce Student Stress so Students Can Focus Again on Learning

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Abstract

The integration of digital and Internet resources has led to class resource clutter: online announcements, discussion boards, posted slides and additional readings, Google docs folders, online textbooks, online homework systems with separate subscription and login, class calendars, posted solutions, lengthened syllabi, surveys, clickers, lecture videos, and more.

Students struggle to find and focus on the core academic content through the clutter. As one student said, "I have to open 10 tabs every day for this class." Students are distracted by the time needed to install and learn how to use each class resource. Beyond the time and technical barriers, such context switches impose significant cognitive load that detracts from core learning.

We conducted a cross-semester study to determine whether aggressively focusing a class' resources can improve student performance. We note that the focus of this paper is in simplifying the class resource structure, rather than modifying the underlying academic content.

The study observed a total of four courses with a total of 528 students. The first study considered two offerings of the same course (an online CS1 Introduction to C++), with the same content coverage and university. The first course offering contained traditional resources, while the second course aggressively simplified and focused class resources. The same study was again conducted for two in-person CS1 offerings: One offering with traditional resources; a second with simplified class resources. The participants were blind to the conditions of the study.

We surveyed the students to measure stress with agreeability questions on a 6-points scale (6 = Strongly agree, 0 = Strongly disagree). We found that students preferred the focused resources, enjoying the class more and experiencing less stress, than students in a class with traditional resources. For example, students with the focused resources reported a 4.9 of 6.0 for enjoying the class, which was significantly higher (p-value < 0.001) than students with the traditional resources reporting 4.1 of 6.0.

Further, this paper includes concrete suggestions for focusing class resources, including a curated list of suggestions from a few dozen instructors and course designers, and a step-by-step process.

Introduction

The digital revolution of higher education has led to more complexity in course design, such as: online announcements, discussion boards, posted slides and additional readings, Google docs folders, online textbooks, online homework systems with separate subscription and login, class calendars, posted solutions, lengthened syllabi, surveys, clickers, lecture videos, and more. Such complexities can increase extraneous cognitive load for students, as well as excessive context switching, which increases student stress. By reducing such complexities, students can focus more on learning course content.

This paper documents and explores how to simplify class resources, including a cross-semester analysis measuring the effects on student stress after aggressively simplifying a class' resources. This paper identifies many course design items and issues, and suggests ways to simplify such items. Further, this paper gives a real-world example of simplification of a course's design and details a step-by-step process for simplifying a class.

Background

Some researchers have investigated reducing course administration[1, 7]. Carter[1] simplified course administration by replacing a course website and syllabus with a single wiki. Carter reported improved better communicate with students and better engage students, especially non-traditional students.

Recently, Harrington[5] held a one-time survey and focus group (approximately 1 hour in total) with 149 participants to determine whether participants preferred a short syllabus (6 page), medium syllabus (9 pages), or a long syllabus (15 pages). Harrington reports that students tended to have a better attitude toward the course and instructor with the medium or long syllabus. One explanation is that the participants may have preferred having all course administration in a single place, which in this case was a syllabus. In contrast, this paper surveyed students after 7 weeks of being in an actual class using simplified course administration. Also, note that the simplified class in this work used a 1 page syllabus; the shortest syllabus considered by Harrington was 6 pages.

Cognitive load[9] is the amount of mental effort required by a learner to process information and learn a concept or skill. Cognitive load theory[6] defines three types of load: intrinsic, extraneous, and germane. Intrinsic load relates to the difficulty of the material. For example, adding two small integers has less intrinsic load than dividing two large integers. Extraneous load relates to how the material is presented. For example, a description of a square using a drawing has less

extraneous load than with verbal descriptions. Germane load relates to the effort required to process the information and develop an organized pattern of thought.

Instructional design researchers have sought to increase the learner's germane load and reduce the extraneous load[10, 11], including reducing cognitive load for specific course content[6]. This paper focuses on the reduction of extraneous load by simplifying course design, so students can focus on learning the course's content.

Working memory is the memory used by a person while thinking, which includes information from long-term and short-term memory, as well as transient ideas and thoughts. Working memory has been shown to be critical for learning[2]. Simplifying class design may free working memory for studying course content, enabling more efficient and effective learning.

Further, class workload is among the top-5 stressors for college students[8]. Simplifying a course can help reduce student workload via reducing course administration, e.g., making deadlines more obvious and assignment expectations less cumbersome.

Collection of Course Components, Issues, and Solutions to Reduce Extraneous Load

There are numerous potential issues with a course's design that can increase the extraneous load. This section identifies many of these potential issues and provides techniques to address each issue.

This paper's authors held a workshop on simplifying course design for approximately 40 instructors and course designers from various colleges and universities. As part of the workshop, the paper's authors opened the floor to attendees to contribute their experiences. Attendees were asked to help identify class components, the common resources used within a course offering along and common issues associated with these resources. Attendees were also asked what/how resources could be simplified. The collection of ideas are in Table 1 and 2. The ideas are also hosted online[3].

Table 1: Collection of class components and issues that may be considered for simplification. Italics were ideas added by workshop attendees.

Class components and issues	**Comments**
Textbook	● Student decision issues: Buy or rent? New or used? Buy from company or private? Delivery option? What if not

	received? Electronic version? Old edition free pdf? Skip entirely? ● Potential issues: Access keys and platform
Homework systems	● Content consistent with course? ● Cost low-enough that all students acquire? ● Potential issues: Login, grade transfer, and platform
Homework turnin method	Supposed to submit Word, PDF, scanning, or something else?
Clickers	Buy? Rent? Where is best deal? Need batteries? Need periodic recharging? Must remember to bring to lecture.
Lengthy course administration documents	● Ex: 14-page syllabus ● No incentive for instructor to shorten.
Learning management system (LMS) / Course web sites	● Login ● Announcements ○ Access ○ Email / digest ○ University or private account ○ Excessive emails ○ Spam ● Discussion board ○ All above plus… ○ Required / optional posts ○ Participation requirements ○ Public / private posts ○ Another login (ex: Piazza) ● Assignments / quizzes ● Class calendar ● PowerPoint slides ● Wikis ● Peer grading ● Videos (lectures, supplements)

	• Gradebook monitoring • Other posted items
Web browser compatibility	*Websites don't always work across all browsers.*
eBook compatibility across browser/system	*Ex: Can't always copy/paste or print*
Course requirement functions on Mac/Windows/Chromebooks?	*Some operating systems may not be supported.*
Both Microsoft Word and OpenOffice supported?	
Background knowledge in related domains needed to understand course's material	*Ex: Computer science requires learning a programming environment*
Who should students contact for help?	*Email? Cell? Office hours?*
Restrictions to website access	• *May be blocked from useful websites* • *Students can defeat or circumvent*
Proctoring issues in non-traditional settings	• *How do students find a proctor?* • *Another contact to remember*
Stressors associated with enrollment	*Ex: Specific classes, times, on campus, off campus, dependencies, other responsibilities*
Hybrid classes may be unfamiliar	*How do they work? Students/instructors may be new to these.*
Faculty may be confused by technology options. Ex: Blogs, wikis.	• *Require students to use?* • *Accessible?* • *How to navigate? How to choose?*
Multiple options for software tools	• *Complexity vs simplicity* • *Have support for using?* • *Cost? 90-day trials? Buy? Student version?*
Team projects	• *Coordinate time/effort with other students* • *Bad group?*

	• *Students not trained to work in group*
Non-traditional student population	• *May have work / kids* • *Social life?* • *School time limited* • *Complications amplify problem*
Outside social events	*May lead to conflict in schedules*
Disconnect between professors and students	• *Ex: Prof assumed student knew how to blog. Prof said call IT or google it.*
Critical due date but tech support unavailable	
Teaching the person who you think you were supposed to be teaching?	
Name confusion: Where to find URL? Where to submit?	
Terminology confusion: Hybrid, course outcomes, etc.	
Insufficient preparation: Research skills, information literacy	

Table 2: What/how to simplify class components and issues. Italics were ideas added by workshop attendees.

Class components or issue	**Comments**
Syllabus	Strive for one page.
Unique websites for course	Strive for one website.
Knowing when to delay items	• Didactic: Ex: Introducing to C++ environment in later week when necessary • Administrative: Give information at relevant times. Ex: Discussion of academic dishonesty near midterm
Remove items	Ex: Low-value weekly course surveys

Announcements	Minimize number and length
Require attendance	If required, then fewer choices to be made.
Avoid redundancy with instructional matrix	
Consistency between weeks	● *Make weeks similar, so it's clear what's expected next week* ● *To-do list for what's due*
One method of communication	*Ex: Discussion board, email, office.*
Use previous course content to build foundation for next course	
Use feedback to improve course	
Get faculty to submit feedback	*Make it easy*
Make it easy to find information	*Don't have multiple levels to find something*

Real-World Example: Course Design Simplification

One of the paper's authors used the following course design simplification for an all-online course he was teaching: Introduction to Computer Science in C++, shown in Table 3. These simplifications were made prior to the workshop described above.

Table 3: Real-world example of simplifying a course's design for an Intro to Computer Science course.

Class components	**Comments**
1-page syllabus	● Previously 4 pages. ● Concise wording, less unnecessary text.
Single Google Docs folder with all materials	● Previously on Blackboard, Piazza, Adobe Connect ● Materials included: Syllabus, lecture recordings, past exams, etc.
Integrated textbook, homework, and labs in single "zyBook"	● Previously a textbook, plus a separate homework system, plus a separate lab system. ● Now students just "Do Chpt 1".

	● All due dates also integrated in "zyBook" (was in Google Calendar).
Delayed / removed items	● Introduction to C++ environment (3rd week instead of 1st week) ○ Environment not needed until 3rd week ● Discussion of academic dishonesty (4th week instead of 1st week) ○ Week of discussion chosen shortly before high-stakes exam. ● Removed weekly course surveys (not helpful to improving course)
Minimize number and length of announcements	Removed 2-page "welcome letter" and 1-2 online announcements per week.
Required student attendance	Removes a tough decision for young students.

Table 3's course design simplification followed three steps:

1. Recognize the problem
    a. Put self in student's shoes
2. Build with less components
    a. Ex: Make the book required? Integrated homework and lab assignments?
    b. Minimize logins / postings / required items. Keep quality items.
3. Reduce remaining components
    a. Ex: Remove text / announcements. Less is more.
    b. This step requires effort.

Step 1 takes the least time and helps inform decision-making in step 2 and 3. Step 2 might be accomplished by starting with a blank sheet and organizing the critical items. Step 3 requires conscious effort and practice, but may significantly improve clarity of expectations.

Student Stress Reduced After Simplifying Course Design

We analyzed student stress before and after simplifying the course design of CS1 Introduction to Computer Science in C++ (course number CS10 at University of California, Riverside). The previous section details the simplifications to course design that were done.

528 students across four course offerings participated, as shown in Table 4. Two offerings used not-simplified course design (Spring 2015), and the other two used a simplified course design (Fall 2015). One offering from each quarter was an all-online class and the other offering was an in-person class. The Spring 2015 all-online offering had a different instructor than the Fall 2015 all-online offering. The Spring and Fall 2015 in-person classes were taught by the same instructor.

Table 4: Participant breakdown across 4 CS1 offerings.

	Not simplified	Simplified
All-online offering	87	71
In-person offering	109	261

The exact number of solicited students is not available. All students enrolled in each course offering were solicited by that offering's instructor. The all-online offerings had a maximum enrollment of 100 students each; the not simplified, in-person offering had a maximum enrollment of 140 students; and, the simplified, in-person offering had a maximum enrollment of approximately 300.

For each offering, students were given a survey on class stress. Students submitted the survey anonymously. The students were blind to the experimental conditions.

Each question of the survey was on a 6-point agreeability scale (6 = Strongly agree, 5 = Agree, 4 = Slightly agree, 2 = Slightly disagree, 1 = Disagree, 0 = Strongly disagree). The survey was created by the paper's authors and included the following questions:

- I enjoy the class
- This class is an appropriate amount of work per week for the number of units.
- I feel prepared for the Final exam.
- I am often anxious about the class
- I spend a lot of time in the class figuring out system issues rather than learning programming.
- The number of tools and websites for this class are somewhat overwhelming.
- I have missed a deadline because I thought it was another time.
- I have looked for class info but couldn't find it.
- I feel anxious about the Final exam.

The survey had a Cronbach's alpha of 0.74^4 across the 9 questions and 528 participants.

As shown in Table 5, students in the simplified course design reported a 5.0 out of 6.0 in enjoying the class, which was more ($p < 0.001$) than the 4.1 reported by students in the not-simplified design. Also, students in the simplified design were less stressed. In particular, students in the simplified design reported feeling less overwhelmed by tools and websites (2.9 vs 3.5; p-value = 0.02) than students in the not-simplified design.

Table 5: Student survey responses for the all-online offerings that had significant or near-significant differences. Bold means best.

	Not simplified	Simplified	p-value	
I enjoy the class.	4.1	**5.0**	< 0.001	Higher is better
The number of tools and websites for this class are somewhat overwhelming.	3.5	**2.9**	0.02	Lower is better
I have missed a deadline because I thought it was another time.	3.4	**2.8**	0.09	
I feel anxious about the Final exam.	4.5	**4.0**	0.10	

Table 6: Student survey responses for the in-person offerings that had significant or near-significant differences. Bold means best.

	Not simplified	Simplified	p-value	
I enjoy the class.	4.1	**4.9**	< 0.001	
This class is an appropriate amount of work per week for the number of units.	3.8	**4.4**	< 0.001	Higher is better
The number of tools and websites for this class are somewhat overwhelming	3.6	**2.4**	< 0.001	Lower is better
I have looked for class info but couldn't find it.	2.4	**2.1**	0.07	
I have missed a deadline because I thought it was another time.	3.4	**2.2**	< 0.001	

As shown in Table 6, students in the simplified course design reported a 4.9 (out of 6.0) in enjoying the class, which was more ($p < 0.001$) than the 4.1 reported by students in the not-simplified design. Students reported the amount of work was significantly more appropriate in the simplified design than the not-simplified. Further, students reported being significantly less overwhelmed and missed fewer deadlines in the simplified design than the not-simplified design.

In both the all-online and in-person offerings, students reported enjoying the simplified course design more, found the tools less overwhelming, and missed fewer deadlines than the not-simplified. Further, students favored the simplified course design across all questions that had significant and near-significant differences.

Conclusion

The paper provides an itemized list of course design issues and solutions, which may be helpful to simplify a course's design and reduce the extraneous load associated with the overwhelming number of resources that have led to class resource clutter.

A real-world example is provided that follows a 3-step process to simplify course design. The non-simplified and simplified versions were compared across four course offerings. Results show that students significantly preferred a simpler course design. Students using a simplified course design rated "I enjoy the class" with a 4.9 out of 6.0 (6.0 = Strongly agree), which is significantly higher (p-value < 0.001) than the 4.1 out of 6.0 rating that students using a not-simplified design gave. Also, students' stress significantly reduced after simplifying course design, including reduced anxiety, reduced number of missed deadlines, and reduced overwhelming feelings.

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