What Belongs in a Computer Science Syllabus?

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Abstract—This work-in-progress research paper studies the role of the syllabus in a computer science course. There is considerable literature detailing why a syllabus is an important part of a lecturer's tools, and what items a syllabus ought to contain. However, there is little empirical evidence to back up these claims. We investigate what computer science students report seeing (and wishing to see) on a syllabus, and compare those results against advice given in various syllabus design guides. We find that several topics listed as points of emphasis on syllabus guidelines are named by students both as important and as areas for improvement in syllabi. We do this as a first step towards developing a research program to derive meaningful data on what a useful computer science syllabus really contains.

1. Introduction

The class syllabus given out on the first day of lecture is a universal component of undergraduate (and computer science) education. Numerous papers detail why a syllabus is an important part of an instructor's toolset, and what items a syllabus ought to contain. However, there is little empirical evidence to back up any of these claims.

We investigate what students report seeing (and wishing to see) on a syllabus, as a first step towards a research program to derive meaningful data on what a useful computer science syllabus should contain. Based upon a literature review, we surveyed computer science students at Kettering University to determine what they viewed (prompted and unprompted) as important elements of a course syllabus. We compare these results with a number of contemporary syllabus design documents to see how well conventional design wisdom aligns with student desires.

2. Background

We reviewed the relevant literature to find previous work on the desirable traits of university syllabi. We found a number of guides from university teaching centers, as well a small number of published papers. We attempted to find work expressly discussing computer science courses, but did not limit the scope of our reading.

The papers we found largely fall into one of two categories. Some focus on describing the purposes of a syllabus, with explicit guidance on how to achieve those goals. Others present lists of items to include in a syllabus, without explanation or justification.

Walker [1] declares that syllabi exist to provide the reader with three items: the context of a course, the details of a specific offering of a course, and cultural expectations. Parkes and Harris [2] state that syllabi serve as a contract, a permanent record, and a learning tool. Johnson [3] outlines various common syllabus sections, and concludes that "...a well-written syllabus will help the students in the learning environment and will assist faculty members as they teach".

Using Walker [1] as well as two syllabus guides from University teaching centers ([4], [5]) as our starting point, we identified eleven major categories of items usually recommended to be included on a syllabus:

- "Nuts and Bolts" information — Course name, meeting times and locations
- Course purpose — Relation of course to program of study, necessity in field, usage in industry
- Course objectives — Specific skills and abilities students ought to gain or improve from the course
- Course format — Mode of teaching, whether lecture, lab, field work, etc.
- Required materials/resources — Items necessary for the course outside of standard class materials
- Required texts/bibliographies — Books needed, along with ISBN, expected prices, etc.
- Schedules — List of meeting dates, topics to be covered on those dates, and assignments due
- Grading schema — Description of assignment weighting, letter grade scale, etc.
- Late/attendance policies — Clear statement of penalties and options for missing class or work
- Teaching strategies — Discussion of instructors beliefs on teaching, how course should be approached
- University policies — Usually regarding students with disabilities and academic integrity

Notably absent in these sources, however, is any sort of justification for the inclusion of these items, as opposed to any other items that might be included. The authors simply

appeal to their own experiences or authority in making their claims.

Additionally, there is no discussion of things that might be excluded from a syllabus, or any criteria that might be used to judge whether or not an item should be included. In our judgment, this leads to syllabus bloat, as faculty are encouraged (or mandated) to include more and more information into a single document, without any thought as to the purpose the document should serve.

The perception of syllabus bloat seems commonplace. Authors such as Schuman [6] report that "today's college syllabus is longer than many of the assignments it allegedly lists". As a more recent example, the 2017 version of the Beloit College Mindset List [7] reports that today's students "will find that college syllabi, replete with policies about disability, non-discrimination, and learning goals, might be longer than some of their reading assignments."

In summary, there seems to be little consensus regarding what should and should not be present in a syllabus. As part of our background research, we reviewed computer science course syllabi from four different institutions (San Diego State University, University of Georgia, University of Texas, and Kettering University). Our impressions from reading these syllabi were that, even for similar courses across universities, the amount and types of information supplied varied greatly, with no clear consensus on which items were more important than any others.

Certainly we don't claim that syllabi serve no useful purpose in computer science classrooms (or any classrooms, for that matter). We simply note that we have no empirical evidence to justify whether any particular topic should be included or excluded from a given syllabus. While that lack of empirical evidence does not imply that syllabi should be abandoned [8], we hope to find some empirical evidence to guide faculty in syllabus creation.

3. Methodology

In February 2017, we sent an email message to all 129 registered computer science majors at Kettering University, inviting them to complete a five-question survey hosted by Google Forms. Twenty-seven students completed the survey. Our goal was to discover what students think about the purpose and content of course syllabi, test their recall of typical elements included on syllabi, and ask for their opinions on items that should appear.

The survey contained the following five questions:

1) What are the primary purposes of a syllabus? (short answer response)
2) What items do you remember seeing on a syllabus? (short answer response)
3) Which of the following items do you recall seeing on a syllabus? (multiple selection response)
4) Which of the following items do you believe your syllabi have been lacking, or would be useful to have more of in the future? (multiple selection response)

TABLE 1. SURVEY RESULTS (SYLLABI ELEMENTS)

(n=27)	Q1 (Purpose)	Q2 (Recall)	Q3 (Prompt)	Q4 (More)
Nuts and Bolts	33%	59%	96%	7%
Purpose	0%	4%	52%	33%
Objectives	56%	56%	74%	22%
Format	0%	0%	52%	41%
Required Material	0%	7%	85%	30%
Required Texts	4%	7%	82%	15%
Schedules	52%	78%	93%	41%
Grading Schema	41%	59%	96%	26%
Attendance	7%	19%	85%	26%
Teaching Strategies	48%	30%	22%	41%
University Policies	4%	37%	93%	11%

TABLE 2. SURVEY RESULTS (HELPFULNESS)

1 (Not at all)	11%
2	15%
3	26%
4	37%
5 (Yes, significantly)	11%

5) Overall, do you think your class syllabi have helped you to learn more or perform better in class? (1-5 Likert scale)

Questions 1 and 2, calling for unprompted short answer responses, were presented on separate pages from the following questions, in order not to bias student responses in favor of our supplied list of characteristics. Questions 3 and 4 used the characteristics identified during our literature survey for prompted responses.

Questions 2 and 3 appear to be extremely similar. Note, however, that Question 2 asks for students to identify parts of a syllabus from memory, while Question 3 asks for students to identify parts of a syllabus from a supplied list of options. We expect to see differences in response rates between Questions 2 and 3; often, those differences point out items that may be of less importance to students.

Student responses to Questions 1 and 2 were coded by the first author and tabulated alongside the remaining questions. We note that the penultimate category of "Teaching Strategy" tended to collect "other" responses not fitting nicely into one of the other categories; most responses here seemed to be suggestions from the instructor that guided students towards particular attitudes or actions helpful to the course. This makes the category difficult to analyze.

The results of the tabulations on the first four questions are shown in Table 1. Results are expressed as a percentage of total responses received. The results of the final question on the helpfulness of syllabi are shown in Table 2.

4. Analysis

We began our analysis by looking at each individual question for answers frequently mentioned by respondents.

Unprompted, students tend to recall the most "mechanical" items present in a syllabus: schedules, grading schema, and nuts-and-bolts details. This seems unsurprising; these

are sections that students may reference frequently throughout a course, and expect to have available in the course syllabus. Traditional writing guides for syllabi ([1], [4], [5]) emphasize the importance of such materials.

Notably absent in student unprompted responses is any mention of course purpose or format. While course syllabus writing guides emphasize the importance of such topics, students seem to not realize that such items could (or do) appear in syllabi. We speculate that such materials do not appear in syllabi often enough for students to recognize them as part of a standard syllabus.

We now look at each syllabus item in turn, noting where significant differences appear between student recall (both prompted and unprompted) and student desire for inclusion in future syllabi.

4.1. Nuts and Bolts

The survey results here are unsurprising. A third of surveyed students consider "nuts and bolts" information as a primary purpose of a syllabus. 59% of students recall its presence unprompted. Almost every student recalls its presence when prompted, and almost every student declines to ask for more such information. This seems to be a stable part of student expectations in a syllabus.

4.2. Course Purpose

We note that almost no students cite this as a purpose of a syllabus or report it unprompted, and only half of students report seeing it when prompted. A third of students express a desire to see more of this in syllabi. This seems to synchronize well with advice from syllabus guides ([1], [4], [5]) calling for greater emphasis in this area.

4.3. Course Objectives

For students, lists of course objectives are a commonly accepted part of course syllabi. Half of students recall their presence unprompted, three-quarters of students recall their presence when prompted, and few students suggest their further development. This seems to confirm traditional practices.

4.4. Course Format

The results here are worthy of note. No students recalled their presence unprompted or offered it as a primary purpose. In contrast, 41% of students reported wanting to see more of these items. While faculty clearly spend significant time designing how courses will be presented, they may not be spending much time discussing such structures (or the reasons for them) with their students. Explicitly discussing course format may be a worthy expenditure of syllabus development time.

4.5. Required Materials

We are unsurprised by the results for this item. Few students see required materials as an essential purpose or recall it unprompted. Most students recall seeing it when prompted, and few students want to see more of it in syllabi. This seems to be an appropriate judgment for a mature element in most syllabi.

4.6. Required Texts

The results here are extremely similar to those seen in "Nuts and Bolts" and "Required Materials". This mature element is recognized upon recall but not seen as an area for improvement.

4.7. Schedules

This appears to be a syllabus section in need of further attention. Half of students report course schedule as a primary purpose of a syllabus, and most students report it as a component, prompted or unprompted. Yet 41% of students report that they would like to see more of this information they judge as primary to a syllabus. This suggests a neglected area of syllabus development.

4.8. Grading Schema

This seems to be a mature element in most syllabi. Half of all students recall seeing it unprompted; most students recall seeing it when prompted. While some students would like to see more emphasis, perhaps other areas noted by this survey are worth additional emphasis.

4.9. Attendance Policies

This seems to be a classic example of a forgotten syllabus section. Few students report seeing it unprompted, and few students wish to see more of it. We suspect that most students view attendance policies as irrelevant to them, as students don't begin a semester thinking about skipping class. At the same time, most students report seeing such a section when prompted, suggesting that faculty are including such sections to appease administrative demands, or to fall back upon when the need arises.

4.10. Teaching Strategies

This is the most significant result we found in our survey. To our surprise, more students reported teaching strategies as a primary purpose of course syllabi than reported seeing them on a syllabus, prompted or unprompted. 41% of students also report a desire to see more of this sort of information. Syllabus development guides ([1], [4], [5]) routinely call on faculty to include more of this information; this emphasis would seem to reflect student desires.

4.11. University Policies

These boilerplate sections are not viewed as a primary purpose of course syllabi, though almost all students recall them as present when prompted. Few students want to see more of this information. The inclusion of such sections as mandatory and non-memorable portions of syllabi is likely to continue, though students do not report being directly impacted by their presence.

5. Discussion

5.1. Categorizing Results

The survey results for each of these items suggest classification into one of four categories:

1) Items students recall and desire to see more
2) Items students recall and do not desire to see more
3) Items students do not recall and desire to see more
4) Items students do not recall and do not desire to see more

We are pleased to note that none of our results are classified in the final category. At the very least, syllabus development guides ([1], [4], [5]) are not calling for the inclusion of items in syllabi which students neither recall nor wish to see.

The first category of items (*i.e.* items students recall and wish to see more) include schedules, course format, and course purpose. The third category of items (*i.e.* items students do not recall and wish to see more) includes only teaching strategies. All other items fall into the second category (*i.e.* items students recall and do not wish to see more.)

It seems to us that these results suggest that traditional syllabi development advice may be justified. The items most frequently noted in such syllabi as lacking in typical syllabi coincide with the items reported by our students as desirable for further development.

In retrospect, we note that we did not ask our students if there were items which they would like to see less of in a syllabus. While our results seem to justify the current folkloric expansion of syllabi, we missed the opportunity to find student counsel on things which could be removed.

5.2. Threats to Validity

We note that this study is vulnerable to many of the same criticisms that most student opinion surveys receive. Participation in the survey was on a voluntary basis; as a wholly anonymous survey, we collected no data on demographics, yielding the possibility of non-representative samples. Reporting on student opinions of syllabus utility is, of course, different from reporting on syllabus utility itself; students may not be the best judges of how useful a given syllabus item is to their classroom experience.

This study was conducted at a single institution, Kettering University. Kettering University is a STEM-focused private institution with a limited number of degree programs, including computer science. In addition, Kettering University's educational model includes a mandatory co-operative education component, beginning in the first year; students alternate between three-month academic terms and three-month paid work experiences in their area of study. These factors mean that computer science students at Kettering University may not be representative of computer science students at other types of institutions (*e.g.* public, comprehensive universities).

6. Conclusions

In summary, we surveyed computer science students at Kettering University to find if their opinions regarding course syllabi were in agreement with traditional advice given in syllabus development guides. We found that the four areas most often noted by students as needing improvement (schedules, course format, course purpose, and teaching strategies) are those areas most often recommended for improvement by development guides.

One obvious direction of future work would be replication of this survey at other institutions — in particular, institutions with different demographics and purposes than Kettering University. Replication would allow us to observe if these trends are merely localized phenomena or are common to most student experiences in computer science.

Another direction for future work is looking at the syllabus as a communications vehical rather than a legal contract. The literature on effective communication of technical information through written documents is vast, yet unexplored by us; surely there are insights there that would inform this work.

We acknowledge that little of what we discovered in this study appears to be specific to the discipline of computer science, other than our sampling of computer science syllabi in our literature review, and our survey of computer science students. We hope in future work to explore further what might make a syllabus for a computer science course different from, say, an electrical engineering course (or to discover that no meaningful differences might exist).

We invite dialog on future implications of this work, including how to observe whether improved syllabi actually improve either student satisfaction (easy to survey) or student performance (harder to determine).

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