AC 2007-621: INTERPRETING STUDENT-CONSTRUCTED STUDY GUIDES

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Interpreting Student-Constructed Study Guides

Abstract
In this work we explore how ten Tennessee Tech chemical engineering students in a second-semester thermodynamics course prepare and utilize self-constructed study guides for use on class exams. Qualitative research methods were used owing to the information desired and the small number of participants. Results indicate that many strategies exist and "goodness" of study guides does not necessarily map onto successful exam performance. Also, students may need detailed training on how to develop a useful study guide. Finally, we have found that there may be a benefit to peer-sharing of study guides.

Introduction

Course examinations are ubiquitous throughout highereducation, regardless of the subject area. When an instructor announces an exam, one question is sure to follow: "Can we use our book and/or notes on the exam?" [That this is asked, and not some default assumed, speaks to the various answers that students often receive to the question above.—this sentence is awkward]

One approach used across fields is to disallow students access to their notes during an exam, but allow some form of reduced or modified notes as a resource. When students are given the opportunity to prepare these notes (heretofore called a "study guide"), this constructivist approach may provide revealing insights on a number of related topics, such as what and how the student prepared this study guide, how they used the study guide, their feelings pre and post exam and so on.

In this work, we examined student-constructed study guides in a second semester undergraduate thermodynamics course taken by 10 chemical engineering students. The goal was to determine how the guides were prepared (re: strategies, etc.) and how they were used on the exams. One hope, at the conclusion of the study, is to provide (if possible) an inventory of best practices for study guide preparation.

Owing to a small class size and the local nature of this research, qualitative methodologies were used. Two semi-structured interviews were conducted with students individually over the course of the semester. The first interview took place after the first exam and the second interview took place after the third exam. Focus groups were conducted after the second exam. Fieldnotes were taken during the interviews. Interviews were tape recorded and transcribed verbatim and discussed with the students for accuracy. Categorizing strategies were used to code data. Categorizing strategies in qualitative research were done to fracture or split the data in order to rearrange it into categories that enhance the comparison of data within and between categories and to help in the development of theoretical concepts. In addition to interviews and focus groups, the students' self-constructed study guides were analyzed. This research uncovered strategies students used in constructing their study guides. By understanding how students constructed their study guides, the course instructor could potentially help future students to enhance their academic performance through the construction of "better" study guides.

Literature review

The literature on this specific area, student-constructed study guides, is quite limited and not totally on-point. While our investigation looked to uncover strategies upper-division undergraduate chemical engineering students use in constructing their study guides, previous research, on the other hand, primarily focuses on enhancing test performance and reducing test anxiety. A few studies examine the effects of dependency on study guides while one study specifically addresses the effects of study guide construction on test performance.

Four studies, in particular, demonstrate that the use of study guides (referred to as crib notes or crib cards in these studies) has no effect on test performance. Hindman[1] examined the usefulness of crib notes with undergraduates. In his experimental design, students prepared 3 × 5 inch note cards to use on exams. He found no effect for the use of crib notes on test scores, but further noted a steady decline in the number of students using the notes over the course of the semester. Trigwell[2] similarly reported no effect on exam performance, and that claims of enhanced learning via the use of crib cards were unsubstantiated. Exam scores of students allowed to use crib notes were compared with scores of students who were not allowed to use crib notes by Whitley[3]. Undergraduate social psychology students constructed one 8.5 × 11 inch page of notes to use on multiple choice and short answer exams. Whitley concluded that "crib notes do not appear to help most students most of the time"[3]. He did, however, go on to explain that student characteristics confounded the results with students in the 8:00am class section scoring higher on the first exam but not on the two later exams, and that there was no effect with the 11:00am class section on all three exams. Dickson and Miller's findings[4] from their study of upper division psychology students further support the claim that crib cards do not improve test performance.

Anxiety reduction through the use of crib cards/sheets is examined by Trigwell[2] as well as Drake, Freed, and Hunter[5] and Dickson and Miller[4]. Although Trigwell[2] found no effect on test performance, he found that students' anxiety was reduced. Test anxiety reduction was the primary purpose for Drake, Freed, and Hunter's research[5]. Psychiatric/mental health nursing students were allowed an 8 × 10 inch crib sheet with their exams. The researchers concluded that the sheets provided a sense of security, hence lessened anxiety in test preparation and test taking. Dickson and Miller, on the other hand, concluded that the use of crib cards on examinations did not reduce anxiety[4]. The fifty-four students in two different sections of the course were allowed to construct a 5 × 8 inch card with information on only one side to use with two of the four examinations. While students initially reported that using a crib card would reduce their exam anxiety (79.2%), after the fact, only 40.5% claimed their card decreased anxiety[4].

There is some concern over the use of study guides as students may become dependent on them rather than use them as a study tool for learning. Dorsel and Cundiff compared four conditions in which "cheat sheets" were manipulated from two perspectives: coding hypothesis (code material for memory, hence facilitate performance) and dependency hypothesis (indispensable crutch, hence hinder performance).[6] The eighty-nine introductory psychology students were exposed to four different conditions: no cheat-sheet (no cs), cheat-sheet/unaware unavailable (cs/uu), cheat-sheet/aware unavailable (cs/au), and cheat-sheet/aware available (ch/aa). The 8.5

× 5 inch sheets were divided into a 7 × 7 matrix. The researchers concluded that the construction of cheat-sheets was beneficial if the student did not become dependent on it as evidenced by students' mean improvement scores: no cs (9.65), cs/uu (5.82), cs/au (10.36), and cs/aa (9.55). Drake, Freed, and Hunter conversely concluded that dependency on crib sheets did not impede examination performance, but rather improved performance because it reduced anxiety.[6]

Most research on study guides seeks to uncover the effects of using the guides rather than investigating the construction of the guide itself. Dickson and Miller, however, compared the effect of self-constructed guides to other-constructed (student research assistant developed) guides.[7] Thirty-two undergraduate students used the guides on multiple-choice exams. The researchers concluded that students performed better on exams using the other-constructed guides and further claimed that self-constructed guides did not enhance student learning or exam performance.

While literature on student-constructed study guides is somewhat limited and has a slightly different focus from our research, some researchers[1,2,5] agree that the real value in the guides is the construction itself. Study guides may not increase examination performance or reduce anxiety but writing the information down and organizing or clarifying it, may help enhance student understanding. Furthermore, Trigwell concluded that study guides help to save time on exam performance despite unsubstantiated claims that they enhance learning.[2]

Purpose and methods

The purpose of our research was to determine and understand (1) what strategies students use to decide what to include in their self-constructed study guides, and (2) how the students used their guides on the exam. As participants in institutions where "a publicly available system of intelligibility" precedes us, we construct meaning within this pre-existing system.[8] Hence, meaning is constructed rather than created because we are working/learning within already existing meanings and understandings. Students come to us with prior knowledge and experiences and we, as teachers, work to facilitate their learning of new, different, or additional information. One way for us to attempt to understand student learning and meaning-making is to investigate their methods of constructing study guides. By understanding how students construct and, ultimately, use their study guides, we may be able to determine best-practices in the construction and utilization of the study guides.

Ten participants, all students enrolled in ChE 3020 (Chemical Engineering Thermodynamics II), were requested to participate. At the first class meeting of the semester, the research project was explained to the students and informed consent forms were passed out. If they agreed to participate, they were asked to return their informed consent forms. We used qualitative methods, specifically two semi-structured individual interviews, one focus group, and document (study guide) analysis to collect data.

Course requirements included three exams and a comprehensive final exam. Interviews and the focus groups were scheduled the two days immediately following the exam. We met in the engineering building to facilitate easy access for the students. The interviewer (who was not the course instructor) had copies of the students' un-graded exams and study guides in order to ask direct questions about the guide and how the students decided what to include or exclude. Interviews were digitally recorded and within a week of the interview were transcribed verbatim by the interviewer. Fieldnotes were also taken during the interviews. Students were assigned a number in order to ensure confidentiality. The interview questions for both interviews were as follows:

1. How do you think you did on the exam?
2. How helpful was your study guide?
3. How did you decide what to include?
4. How much did you use it?
5. Do you think creating the study guide helped you learn?
6. Will you change your study guide preparation next time?
7. Does this experience give you any insight into your learning or preparation for exams?
8. When did you put the study guide together?
9. What would you call your "approach" taken to construct the study guide?

The transcribed interviews were initially word processed per student. The data was then categorized by each interview question to fracture or split the data in order to rearrange it into categories that enhanced the comparison within and between categories and to help in the development of theoretical concepts. Each data set (two interviews and one focus group) was distributed to the research team so each could code the data individually. We later met as a group to discuss and compare our codes. The coding schemes from this meeting were later word processed and fractured to again enhance comparison within and between codes. The research team also met to discuss and analyze the study guides. We went through each student's three study guides individually and then placed the guides on a large table in the form of a grid in order to look across all the guides to distinguish similarities and differences. The chemical engineers on the research team described what they saw and made comments about the guides while a third member of the research team took notes. These notes were later word processed, fractured, and distributed to the team for their feedback.

Findings

Usage

The content of study guides determined its helpfulness and their use during exams. If the content matched that of the test, students replied the guide was useful. Conversely, if the content failed to match the exam, students responded the guide was not helpful. The ten students who participated all had varying definitions and explanations of what it means to learn in this particular class, hence affecting their use of study guides. Some students reported that learning simply meant memorizing the information for examinations or knowing where to find the information for the exams. Most, however, differentiated between conceptual understanding and applied understanding. They reported they need both types of understanding in order to apply techniques to new situations at the same time comprehending the underlying concepts. In terms of learning from their study guides, students resoundingly explained it was the process of constructing the guide rather than the end product that helped prepare them for the exams and possibly learn. They used words such as *organize*, *remind*, *refresh*, and *repetition of materials* to describe how the construction of the guide helped in the process of preparing for the exam. They described how constructing the guide helped them to remember the information for the exam, and that they learned through this process.

What is provided below are some of the most telling comments made by students during their interviews. On the issue of the utility of the study guides, students had the following to say:

- *"It's more that if I write it down, I remember it."*
- *"The purpose of a course is to learn and if you do this [construct a study guide], I think you learn more."*
- *"The study guide is a learning experience."*
- *"I think it [the study guide] helped me especially to do it [the exam] faster which is always good to have more time to solve the difficult questions.*

Strategies

Students outlined a number of various strategies they used to decide what to include or not include on their study guides. For some, the guide was essentially a condensed version of their class notes (see Figure 1) while for others, included what they could not memorize or any material they did not understand or had trouble (see Figure 2). The latter led to larger font sizes and areas of empty spaces. Regardless of the preparer, most students described their inclusion of material as that most emphasized by the instructor; anything he "boxed" on the board, and some even said they reviewed and included the course objectives outlined in the syllabus. A few students responded that it was their (not the instructor's) responsibility to determine what to put on the guide in preparation for the exam. When asked what, if anything, they would do differently in succeeding exams, most students said they would include more example problems because there was too much information to memorize. A few explained they would pay closer attention to the course objectives and one student described how he would "refine" his thought in constructing his guide.

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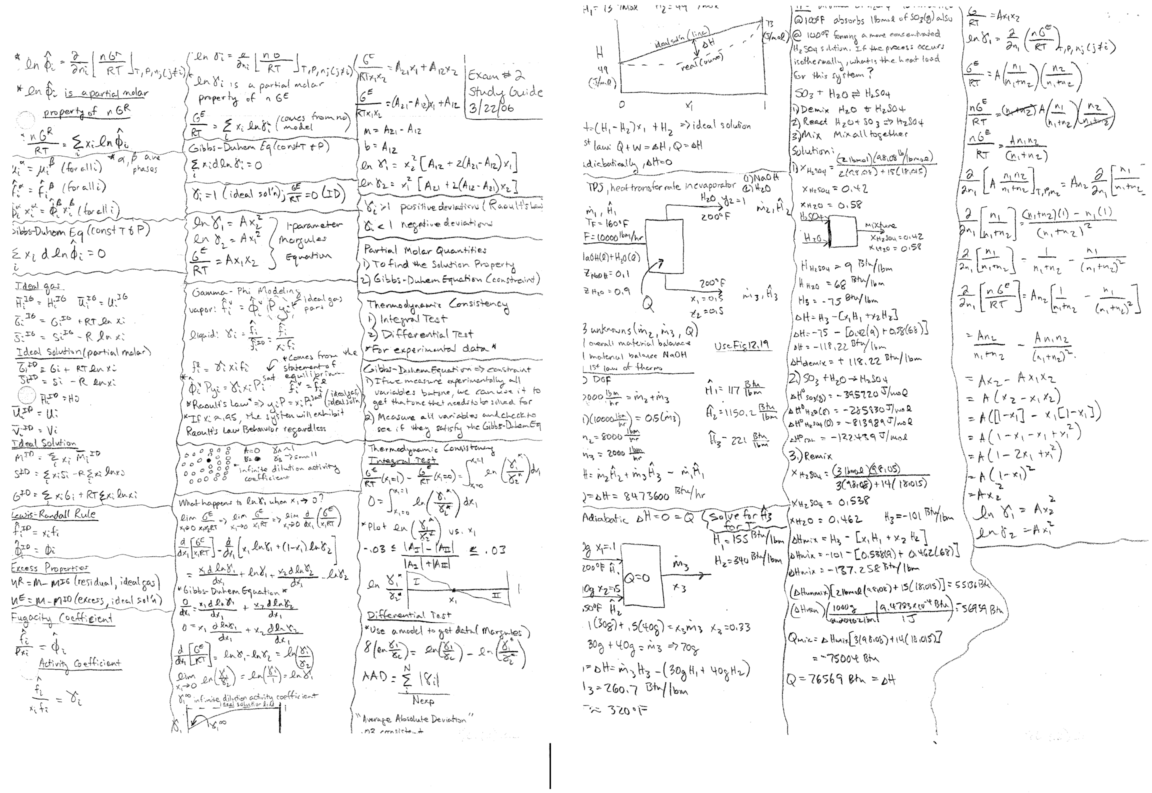

Figure 1: Sample of Student-constructed Study Guide for Exam 1

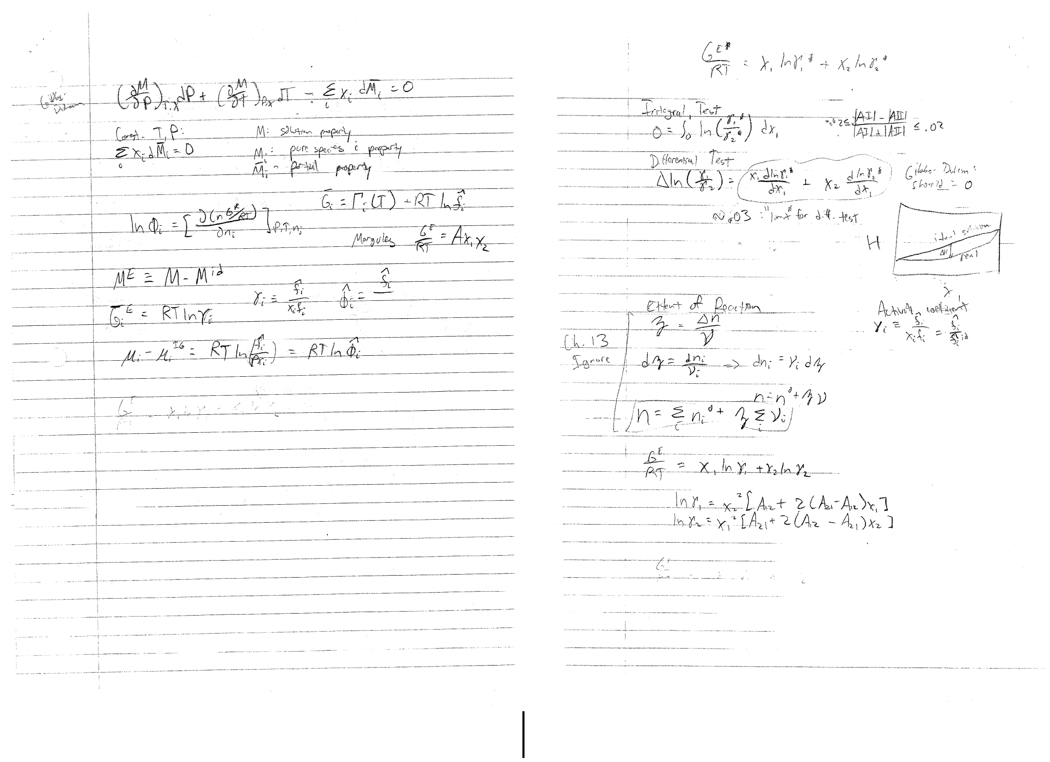

Figure 2: Sample of Student-constructed Study Guide for Exam 2

On strategies to prepare the study guide, students comments with the following:

- *"I go ahead and write it down instead of memorizing it."*
- *"The problems that I felt I didn't fully understand I tried to include on there."*
- *"Mostly, I went through my notes. This time I got a little over excited about it and tried to pack as much onto one sheet as possible."*
- *"I read my notes and if he [the instructor] boxed something on the board and starred it, I included it."*
- *"Anything the teacher puts in a table is what he thinks is important and that's probably going to be on the test."*
- *"I went over the objectives he gave on the syllabus."*

Discussion , Implications and Conclusion

Our investigation into the strategies students use in constructing their study guides and how they used these guides led us to a number of conclusions. The major findings are listed below:

- Students rely on their approximations of instructor emphasized material rather than their own judgments.
- Students may not possess the necessary level of development to connect what they are currently learning with prior knowledge.
- Despite claims by the students that constructing the study guides helped them prepare for the exam, this may not be the case (as evidenced by their exam scores).
- Several students moved from a constructivist to constructionist approach to study guide preparation after working in the focus groups.
- Student strategies for completion of the study guide vary widely, but overall reflect a lack of confidence.

We will touch on these points, and more, in what follows.

Usage

For many of the students, learning is equated with memorizing or being able to locate necessary information for the exam. They repeatedly expressed a lack of confidence in their exam performance. They guessed at how they performed on the exams and did so rather conservatively. No one left the exam confident as further evidenced by superstitious behavior like knocking on a wooden table in the follow-up interviews when they explained how they felt they did on the exam. Some students stated that the test did not measure what they knew and one student even explained how he learned from the test itself rather than class participation, homework, studying, or constructing the study guide. Philosophically, this is not what the course instructor wants to happen. According to the instructor, students "should not be surprised by the content of an exam nor should they be unfamiliar with the application of the concepts." Instead of learning on the exam, students should be able to demonstrate mastery of course concepts. Despite guidance in the construction of the study guides with instructional objectives outlined on the syllabus, notes posted on WebCT, and feedback on homework, self-constructed study guides do not necessarily facilitate student learning or improved exam performance. Students rely on their approximations of instructor emphasized material rather than relying on their own judgments. Evidence supporting this conclusion includes students' concepts of learning in comparison to instructors' concepts of learning. Constructionism stresses a collective generation of meaning, yet students may not possess the necessary level of development to connect this additional information with their prior knowledge and experiences. This gap in learning may potentially be remedied through instructor efforts. Instructors need to be aware of the distance between current levels of development and students' potential development. Perhaps discussing this with students as well as emphasizing instructional objectives repeatedly, especially prior to course exams, may help instructors facilitate students' academic performance. Furthermore, an instructor's explanation of his or her own definition of learning, particular to the course, may help students connect their already constructed knowledge to that desired by the instructor. The process of constructing the study guide was repeatedly credited with helping exam preparation. The process was deemed by students as more important than the end product. This concept parallels the course instructor's reasoning for study guide construction and use. By allowing a one sheet, self-prepared study guide, students will ideally review all course material while preparing this guide and make informed decisions as to the importance of the different material. Student reasoning about process rather than product parallels the instructor's concept about study guides. Students repeatedly expressed that the process of constructing the guide helped them prepare for the exam. Our analysis, however, reveals this may not necessarily be the case. Most of the students developed guides in a "readiness process" rather than a "learning process." The guides helped prepare them for exams, but did not facilitate their learning. Again, perhaps further and repeated guidance from the instructor may shift the guide construction to a "learning process."

Strategies

As far as student choice about inclusion or exclusion of material on the study guide, students were approximating what the instructor would put on the test more so than making their own informed decisions as to the importance of material, up to that point in the course. Students explained the information on the exam was different from the information in their notes or that there was simply too much information to include on a one-page study guide. Such explanations are evidence of students' lack of assuredness of the importance of course material and the course objectives included on the syllabus. These findings demonstrate our bias that we believe student-constructed study guides enhance student understanding and learning which, in turn, facilitates exam performance. Strategies for the inclusion or exclusion of material varied widely and did not, in most instances, reflect the instructor's ideas about guide preparation. For many students, they were second-guessing what the instructor would put on the test when they already had that information from the instructional objectives, notes posted on WebCT, and corrected homework. We also witnessed a "fill-the-sheet" phenomenon where students' study guides included a tremendous amount of information that did not necessarily enhance their exam performance or preparation. There was, however, a noticeable change in some of the guides after the focus group meeting. Apparently, prior to the focus group, students did not see their peer's guides. Once they viewed and discussed each other's guides, some students altered their approach to construction. Such sharing is evidence to support constructionist approaches to learning and may be more beneficial than additional instructor guidance. Our purpose was to determine what strategies these students used to decide what to include in their self-constructed study guides with an overall goal of the instructor being able to help future students enhance their academic performance. Our findings, particularly the peer sharing of guides, suggest we may have uncovered one such approach.

In conclusion, this work raises more questions than it answers. For example, would an instructor-prepared study guide provide benefit relative to a student-prepared guide? What about a peer-group prepared guide? Would training in the preparation of a study guide be useful for students? Future work will attempt to explore some of these issues in more detail.

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