

# Authentic Assignments that Foster Student Communication Skills

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# Summary

- Authentic assignments give students real-world tasks that are designed to be seen as significant to most students.
- Several of the tasks that I give students focus on communication skills. These materials provide
  - a sample of those tasks
  - samples of other resources we use in class.
- The particular examples are drawn from courses in software testing, computer law/ethics, and software metrics.
- I could easily apply the same ideas (many of the same materials) to courses in requirements analysis; software design; usability/HCI; project economics.
  - The materials here have been used in some course on these topics.

# *The Bug Evaluation Assignment*

Motivating persuasive  
technical writing

# Why aren't critical bugs fixed?

- Client experienced a wave of serious product recalls (defective firmware)
  - Why were these serious bugs not found in testing?
    - *They were found in testing and reported*
  - Why didn't the programmers fix them?
    - *They didn't understand what they were reading*
  - What was wrong with the bug reports?
    - **The testers focused on creating reproducible failures, rather than on the quality of their communication.**
- Looking over 5 years of bug reports, I could predict deferrals from clarity/style/attitude of report, ignoring severity

# Bug Advocacy

It's not just about reporting bugs.

- It's about presenting a bug in its strongest (honestly described) light.
- It's about presenting a bug in a way that connects with the concerns of stakeholders with influence—and if one particular stakeholder will be most affected, by making sure she gets the message clearly.
- It's about communicating so well that your report enables good decision-making.

**The best tester isn't the one who finds the most bugs or embarrasses the most programmers.**

**The best tester is the one who gets ~~the most~~ **THE RIGHT** bugs fixed.**

**--- TCS 3.0**

# Bug Evaluation Assignment

- Join OpenOffice QA Team
- Phase 1
  - Find an UNCONFIRMED bug, replicate it, improve report in database
  - submit evaluation for peer review, using evaluation scaffold (evaluation framework)
- Phase 2
  - Peer review the comments in the database & the evaluation
- Phase 3
  - Pair up, repeat Phase 1 with two additional bugs
- Phase 4
  - Pair up, review Phase 3 reports using grading structure

# Bug Evaluation Assignment Sources

## Directory: Bug Edit Assignment contains...

- The assignment (AssignmentBugEvaluation2008.pdf)
- 6 video lectures (3 hrs) on bug advocacy
- Slides for the lectures (193 slides)
- Example of additional instructional support, look at the Association for Software Testing courses (free to members)(\$50 membership) at <http://www.associationforsoftwaretesting.org/drupal/courses>
- Evaluation access to AST courses available for faculty: email me
- (Soon, the supplementary course materials AST is developing for bug advocacy will move back to [www.testingeducation.org/BBST](http://www.testingeducation.org/BBST), free availability, but the coached online instruction requires the course)

# *Study-Guide Driven Exams*

Requiring good writing  
on essay exams

# Study-Guide Driven Exams

- Give students a study guide with a “reasonable” number of questions (enough to cover the course reasonably well, but not discouragingly many) at the start of the course.
- All tests and exams take their questions from this study guide.
- Encourage students to work through the questions throughout the course
  - Host discussion groups at the local café (provide hospitality, but little feedback)
  - Online discussion forum for each question
- **This makes it realistic for me to require well-written, well-organized, focused answers** (given that the students have had time to prepare, standards can be higher than for surprise tests).
- Often, majority of students blow the first midterm
- Improvement on second midterm
- Further improvement on final exam
- **RISK:** Without well-communicated, enforced standards, final exam answers are pretty weak.

# Study Guide-Driven Exam Sources

**Directory: StudyGuideBasedExams  
contains...**

- Study Guide for a short course (the one corresponding to the bug advocacy materials) (BAstudyGuide2008a.pdf)
- Study Guide with exam writing tips for a 1-semester course (Fall2006StudyGuideAdvice.pdf)
- 2 video lectures (43 minutes) on grading essay exams. I make these available to the students at the start of the course.
- Slides for the grading lectures (91 slides)
- I've used this exam approach successfully in courses on metrics, testing, law/ethics, perceptual psychology, law of real property. It would fit in any course that uses essay exams.

# *The Interest Analysis Assignment*

Thinking from  
multiple viewpoints

# Interest Analysis Assignment

- Basic task:
  - Analyze a legislative proposal (intrusive defense against suspected copyright infringement), to identify a variety of stakeholders, their interests, and the impacts of the proposal on them.
- Communications skills:
  - Brainstorming
  - Identifying multiple stakeholders who have different interests
  - Thinking through the interests of each stakeholder-category, including conflicting interests within the stakeholder
  - Library search (technical literature, legal literature)
  - Writing (essay), driven by detailed instructions, held accountable to a rubric. (Specification-analysis skills)

# Interest Analysis Assignment Sources

**Directory: InterestAnalysisAssignment  
contains...**

- The assignment (Essay1Assignment.pdf)
- Grading rubric for the assignment (given to students with the assignment)
- Video lecture (16 minutes) to watch for feedback on the interest analysis task
- Slides for the lecture and to structure feedback on the assignment (39 slides)
- These materials have been used in courses on computer law/ethics, testing, and software design. They would also fit readily in courses on requirements and HCI.

# *Testing Contexts*

Another  
multiple-viewpoints task

# Assignment: The Missions of Testing

Your instructor will assign you to a group. Your group will collaboratively develop a report using a wiki.

## Project Description

You are testing a program that includes spreadsheet features. Your work involves testing those features. Your report should consider the following questions, and any others that you think should be added.

- What is your mission?
- How should you organize your testing to help you achieve the mission? For example,
  - How aggressively should you hunt for bugs? Why?
  - Which bugs are less important than others? Why?
  - Suppose the program has a numeric input field. The spec says it must accept single digits, but not how it should respond to letters. Should you test with letters? Why or why not? What if you're time pressed?
- How extensively will you document your work? Why?

# Assignment: The Missions of Testing

## **Group 1: Early Development**

You have joined the development team very early in the project. The project manager has asked you to help her understand the product's risks so that she can manage the programming and later testing more effectively in terms of managing the product's reliability.

## **Group 2: Late Development**

You have joined the development team close to its release date. The project manager expects you to test the product in ways that tell her whether it is ready for release.

## **Group 3: Custom Software**

You have joined a development team doing custom software development, writing this program to a specification that was negotiated and incorporated into the development contract. Your objective is to test the program in a way that lets you determine whether it will be acceptable to the customer (as indicated by conformity with the specification).

## **Group 4: Medical Software**

You have joined the development team for a spreadsheet component of a product that will be used in medical services, to track treatment history, prescriptions, etc. Doctors and nurses will rely on the information stored here when medicating or otherwise treating their patients. Your objective is to test in whatever way will most help the company get approval of the US Food & Drug Administration.

## **Group 5: Computer Game**

You have joined the development team for a role-playing computer game. The spreadsheet features will keep track of character attributes, for example the character's experience points, health, age, and equipment or spells it is carrying.

# Assignment: Missions of Testing

## Process:

- Students develop an answer within their group
- Then split, sending their members to other groups to
  - Learn the group's mission
  - Compare the development contexts across groups
  - Compare the differences in testing strategies advanced for the different contexts—are they appropriate?

## Communication Value

- Students (especially work-experienced students) have to break out of their one-size-fits-all approach to development to think about what approach works for what situation. For many of them, this is difficult, for some it is quite uncomfortable.
- In an online course, we also pick groups to maximize geographic diversity, creating (first, for many) context for them to figure out how to confer across time zones, etc.

# Missions of Testing Assignment Sources

## Directory: Bug Edit Assignment contains...

The assignment (MissionsOfTesting.pdf)

- This assignment is used in the Association for Software Testing's BBST-Foundations course (free to members)(\$50 membership) at <http://www.associationforsoftwaretesting.org/drupal/courses>
- Evaluation access to AST courses available for faculty: email me
- The course materials are also available for free (free reuse) at [www.testingeducation.org/BBST](http://www.testingeducation.org/BBST):
  - <http://www.testingeducation.org/k04/video/OverviewForStudent300.wmv>
  - <http://www.testingeducation.org/BBST/slides/BBSTforStudents.pdf>
  - <http://www.testingeducation.org/BBST/BBSTIntroI.html>
  - <http://www.testingeducation.org/k04/documents/BBSTOverviewPartA.pdf>
  - <http://www.testingeducation.org/k04/documents/BBSTOverviewPartB.pdf>
  - <http://www.testingeducation.org/k04/documents/BBSTOverviewPartC.pdf>

# *The Employment Contract Assignment*

Evaluating controversial  
written materials. Presenting  
both sides of a controversy.

# Employment Contract Assignment

- I often start my computer law/ethics course with this, sometimes using it to structure discussion groups, sometimes to create a first writing experience.
- Several things are relevant in this task
  - This describes typical terms in the contract these students will face. The skeptics are typically convinced by student(s) who have software development work experience.
  - In my experience, several of the students have been offended by the terms each time I use a contract like this. Others are more willing to take the employer's side. That creates opportunity for debate. I ask students to take a position on one of the questions. In a live class, I split the students into groups, shuttle between groups, and get to know the students. In a live class, this task carries across 2-3 1-hour classes, and I have students sometimes present/defend a viewpoint they agree with and other times defend/present the opposing side.

# Employment Contract Assignment Sources

**Directory: Bug Edit Assignment  
contains...**

- The assignment (jobContractDiscussion.pdf)
  - Rubric for evaluating oral presentations in the ethics class
  - Rubric for evaluating oral presentations in the BBST class
- Neither of these rubrics maps directly to this assignment, but I've used rubrics like them to guide oral presentations based on this assignment.

# *The Specification Analysis Assignment*

Analyzing complex sets of  
documents that present  
incomplete and conflicting  
information

# The Specification Analysis Assignment

- Specification-based testing is often framed in terms of small problems:
  - Ambiguity analysis of small blocks of text
  - Identification of a few variables and their relationships, applying some combination-testing heuristic
- These are important, but they don't reflect the real-life problems that distinguish spec analysis to me:
  - Multiple documents, conflicting decisions (most recently documented decisions are not necessarily the correct ones)
  - Multiple cross-references, complex idiosyncratic vocabulary
  - Incomplete: missing details about documented features
  - Incomplete: several features left as implicit (expected but not mentioned or mentioned in passing)

# Spec Analysis: The Task

- Find a well-known open source product that many of the students respect.
- Find a badly documented feature, or cluster of features:
  - We used Firefox places in this particular example: difficult cluster, conflicting views, multiple documents that only recognize the existence/relevance of **some** of the others.
  - OOo (or MS Word) tables / outlines are good candidates if you don't find a better one.
- Use a framework of guideword heuristics (in our case, Heuristic Test Strategy Model) to aid active reading of the documents
- Analyze the documents by populating a map or table derived from the framework.
- The lecture (presented in parallel with the assignment) discusses active reading techniques, multi-document specifications, and implicit specifications. This assignment motivates and applies the lecture.

# Specification Analysis Assignment Sources

## **Directory: Specification Analysis Assignment contains...**

- The assignment (AssignmentHeuristicTestStrategy.pdf)
- The Heuristic Test Strategy Model (satisfice-tsm-4p.pdf)
- A concept map of the Heuristic Test Strategy Model (HSTM.mmap)
- Student work (3 assignment results:
  - Mozilla\_Firefox\_Places.mmap
  - Mozilla\_Places.mmap
  - Mozilla\_Places.xls
- 4 video lectures on Specification-Based Testing (86 minutes)
- Slides for the lectures (specBased.pdf, 55 slides), including another variation on the spec analysis assignment described here (see slides 50-53)

# *Additional Writing Advice*

# Additional Writing Advice Sources

## **Directory: WritingAdvice contains...**

- Slides on editing another writer's paper or presentation (support peer review, paired writing, learning by editing) (levels of editing.pdf, 12 slides)
- Slides on doing a literature review (LiteratureReview.pdf, 40 slides)
- Blog entry on writing multiple choice questions (multipleChoiceQuestions.pdf, 20 pages)
- Outline of things to think about when writing an essay ( 4 pages)
- Concept map (early draft) on the types of models used and the types of things we model in software development

# Programming & Communication

- Student projects:
  - Work with existing open source code rather than writing fresh code:
    - What makes the code more maintainable? (I think, specification by example is more effective than in-line or descriptive-introductory comments)
    - Student team analyzes the code to discover variables, relationships, control flow, features and their interactions—basically, they write the internal and external specs
    - If the process, they form opinions on what documentation strategy would make their code more understandable/maintainable.

# Closing Thoughts

I think that:

1. Problems with high-level structure are more prevalent and more critical than problems with sentence-level expression.
2. We often reward shotgun answers and in doing so train students out of both, critical reading of requirements and focused writing.
3. Imprecision in reading (e.g. reading of requests for the information) creates inaccuracy and irrelevance in writing.
4. Gaps / weaknesses in communication often come from inability to identify the existence of an alternative view or to imagine what makes that view sensible and proper to the person who holds it.
5. Peer review and reflection are at least as effective as instructor feedback.

# About Cem Kaner

Professor of Software Engineering, Florida Tech

I've worked in all areas of product development (programmer, tester, writer, teacher, user interface designer, software salesperson, organization development consultant, as a manager of user documentation, software testing, and software development, and as an attorney focusing on the law of software quality.)

Senior author of three books:

- *Lessons Learned in Software Testing* (with James Bach & Bret Pettichord)
- *Bad Software* (with David Pels)
- *Testing Computer Software* (with Jack Falk & Hung Quoc Nguyen).

My doctoral research on psychophysics (perceptual measurement) nurtured my interests in human factors (usable computer systems) and measurement theory.