
AC 2012-3099: A NOVEL APPROACH TO TEACHING TECHNICAL WRITING

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A Novel Approach to Teaching Technical Writing

This paper describes how ENGI 2304: Technical Communications for Engineers uses best-selling novels to provide course content and to introduce students to the conventions of engineering genres by building on their familiarity with humanities readings. Students read the novels *Pompeii* by Robert Harris and *Prey* by Michael Crichton and complete projects based on or inspired by the novels. This paper explains some standard research projects used in technical writing classes and outlines several problems with these projects before introducing the concept of using literature in a technical writing class. While previous studies by Jo Allen and others have argued against the practice of mixing literature with technical writing, this paper explains a new rationale and procedure for using literature that answers those previous objections. Then it explains how using literature to help teach technical writing concepts provides interesting content for both the professor and the students. For *Pompeii*, groups studied, wrote about, and presented on Roman aqueducts, engineers in Roman society, Roman architecture, volcanic predictions, and the eruption of Vesuvius, while those for *Prey* studied emergent behavior, the feasibility of nanotechnology, the ecological dangers of nanotechnology, and distributed programming. Then the paper describes exactly how literature is used in the class and provides the results of the project using an anonymous student survey. Students enjoyed the projects, and they learned about the forms of engineering writing.

Introduction: The Typical Technical Writing Course

Purpose

This paper describes the use of novels to teach ENGI 2304: Technical Communications for Engineers. The course uses Robert Harris's *Pompeii*¹ and Michael Crichton's *Prey*² to teach engineering writing, ethics, and presentations.

Background

The College of Engineering's required technical communications course is ENGI 2304. According to the course description, the class teaches "engineering communication skills: written

proposals, specifications, progress reports, and technical reports; individual and group oral presentations; essays on engineering ethics, contemporary engineering issues and the impact of engineering decisions.” The goals of the course follow from the description:

- Teach students the forms of engineering writing: proposals, progress reports, technical documents
- Teach students the conventions of engineering writing: grammar, passive voice usage, page structure, paragraph structure, effective use of citations
- Teach students how to give effective oral presentations
- Introduce students to the professionalism required of engineers
- Demonstrate ABET Outcomes
 - Outcome (d): an ability to function on multidisciplinary teams
 - Outcome (f): an understanding of professional and ethical responsibility
 - Outcome (g): an ability to communicate effectively
 - Outcome (h): the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
 - Outcome (i): recognition of the need for and an ability to engage in life-long learning
 - Outcome (j): a knowledge of contemporary issues

ENGI 2304 is one of the few courses in the engineering curriculum that covers the “soft skills” required of ABET. Parts of the ENGI 2304 curriculum must be designed to directly fulfill these ABET outcomes, yet the course must still fulfill the other goals, as well.

One of the problems with such a technical communications course is that it is essentially a course without content. Students are tasked with learning the forms of engineering communication, but the content is not specified. Students must give presentations, but there is no set content to present on. Some options for the content for the written documents and presentations include

- Editing professors’ or graduate students’ drafts of journal articles
- Proposing projects in the community or university
- Proposing a library research project and writing a report on the subject
- Writing a technical manual

- Designing an improvement for an existing device

Course Projects

As a part of our College's initiative to include more undergraduate research and design in the curriculum, the course project was changed from a simple library/informational research project to a design project. Students were tasked with redesigning a light switch, an ink pen, a whole-house water filtration system, a rainwater collection system, or a backyard garden to sustain a family of four. Because our students are sophomores, they were not required to give technical detail but had to maintain the scope of work that they included in their proposal. Students would then explain their newly designed devices in a poster and PowerPoint presentation.

Some student proposals and presentations included a light switch that uses celebrity voices (see Figure 1); a pen that incorporates perfume; a pen that keeps the user awake by shocking the user when his or her pulse drops; a home system that captures rainwater, filters it, and then sends it back to the house; and a light switch that is controlled by an iPhone (see Figure 2).



Figure 1. An example of a student project to redesign a light switch to include different celebrity voices that speak to the user.



Figure 2. Another example of a student project to redesign a light switch so that it is controlled by an iPhone.

These projects met the requirements to teach students the forms and conventions of engineering writing and presentations, but they did not demonstrate some of the ABET soft skills such as engineering ethics, contemporary issues, and the impact of engineering solutions.

There are other problems with having students write about these design topics, as well as the other topics listed above, such as writing technical manuals or doing specific library or information research:

- Topics are removed from a valid purpose
- Students get bored with the topic
- Students are not ready to design
- Students spend too much time learning technical material
- Instructors get bored with the topic

First, the topics are removed from the purpose. In other words, students do not have a context for why the topic is necessary. When a student is asked to redesign an ink pen, that student may be able to do it, but may have no purpose for it, except to fulfill an assignment for the class.

Students realize that nothing will happen with their designs, so it becomes meaningless for them. Because they do not see meaning in the topics or the purpose of the design, they get bored with the topics very quickly. Many students initially see excitement in their topics and in the opportunity to design something, but they lose interest as the semester goes on.

One of the reasons students lose interest in the topics leads to the second major problem with the projects: students are not ready to design. The course is taken during the first or second semester of the sophomore year, and most students have not completed a sustained design project. In fact, the technical communications course is a prerequisite for all engineering design courses, so students cannot be expected to understand the design process when they take ENGI 2304. The course must teach the communication process and not the design process, so it glosses over this content and does not attempt a thorough discussion of how to design. Another aspect of this problem is that students often get bogged down in the research itself or in trying to understand the technical aspects of how a dimmable light switch works. Because they often do not have the necessary information to understand and communicate these complicated ideas and processes, they are bored with the topic and then become increasingly frustrated with their ability to communicate that topic.

Another problem with the typical course project is that the instructors of the course get bored with the topics, as well. Adjunct instructors teach two sections of ENGI 2304, and students in those sections create the same projects over and over. Sometimes a student will come up with an interesting idea, such as a pen that shoots a poisoned dart, but most students have very slight variations on the same ideas. Instructors get bored reading these papers and thus may not teach as vigorously as they would with different course topics.

Discussion: Using Literature in Technical Writing

One solution to the problems listed above is to use literature to spur class discussion and project topics. Much has been written on using literature in technical writing classes, but most of this research was done in the 1980s when technical writing was coming into its own as a scholarly discipline.³⁻⁸ Jo Allen's article⁸, published in 1989 in *Technical Writing Teacher*, argues against using literature, so her work is a good starting point.

Allen says that "Primarily, the value of incorporating fiction seems to be in invigorating the bored technical writing professor or comforting the literature professor-turned-technical writing

professor. Whether this approach holds any value for the student has yet to be addressed.”⁹

“Invigorating the bored technical writing professor” is not a concept that should be dismissed so easily. Professor enjoyment is essential to quality teaching. However, her main point is that technical writing professors must first think about how their teaching materials impact students.

Allen continues to suggest that there are three main problems with using fiction in technical writing: “The purposes and methods of writing, the purposes for reading, and the writer/reader relationship.”⁹ Her point here is that technical writing is different from fiction, so using fiction in the technical writing classroom is potentially harmful to future technical writers. She argues persuasively that the purposes for writing, reading, and how to present oneself to the audience are completely different for fiction and technical writing. Her argument appears self-evident, at least in hindsight. Every technical writing teacher can agree that fiction and technical writing are two very different subjects, and any teacher who introduces fiction into the technical writing classroom should talk about the differences between the two, possibly by using materials such as Table 1. This table explains to students how technical writing is different from other forms of writing, including fiction or creative writing, as well as general academic writing taught in typical composition and rhetoric classes.

Allen makes two assumptions, then. First, she assumes that teachers who introduce literature into their composition classes use fiction as examples of technical writing without explaining the difference between the two. Then she assumes that teachers of fiction do so because they want to teach fiction *as fiction*. She assumes that most technical writing professors were trained in literature because they love literature, not in technical writing because they love technical writing. Therefore, they introduce fiction into the technical writing classroom in order to teach what they were trained in: literature.

Allen’s concerns can be addressed by changing the purpose of literature in the technical writing classroom. In ENGI 2304: Technical Communications for Engineers, literature is used for four reasons: to write about the technical subjects in the novels, to write about contemporary issues, to write about ethics, and to do information research.

Table 1. This chart is used in class to explain the differences between technical writing, general academic writing, and creative writing, or fiction

	Technical Writing		General Academic Writing (Expository or Persuasive)		Creative Writing
Purpose	To inform		To persuade, argue		To entertain
	To instruct				
Content	Factual, straightforward		Factual, straightforward		Imaginative, metaphoric
Format	Proposal	<ul style="list-style-type: none"> • Introduction <ul style="list-style-type: none"> ○ Background ○ Purpose • Methodology • Results • Conclusions 	No set format	Thesis	No set format
	Progress Report			Reasons	
	Technical Report			Evidence	
Style	Writing is simple—declarative sentences		Writing may draw attention to itself		Writing is the important part
	Concise sentences and paragraphs		Longer sentences and paragraphs		May include long sentences for effect
	Avoid personal	<ul style="list-style-type: none"> • Personal pronouns • Personal judgments • Personal feelings 	Personal may be assumed, even in academic arguments		Narrators, etc.
	Formal		Formal		Informal, figurative
	Clear topic sentences		Clear topic sentences, may vary for argumentative effect		No clear topic sentences
	Specialized vocabulary		Some specialized vocabulary, depending on audience		No specialized vocabulary

Students begin the semester by working on group presentations that teach the class aspects of Microsoft Word, PowerPoint, Excel, and Project. These hands-on presentations, taught by student groups, provide a basis for document creation and project management. Then students begin their longer projects on literature. They produce a letter of intent, proposal, progress report, final report, final presentation, and poster for each of the novels they read.

Students read two novels: *Pompeii* by Robert Harris and *Prey* by Michael Crichton. *Pompeii* is an action novel about an aqueduct engineer in charge of the aqueduct in the Bay of Naples. The engineer is, in fact, the hero of the novel, and the students enjoy reading about an engineer who understands science, even if his understanding is basic. Several students mentioned that they see themselves in the engineer because the engineer doesn't believe anything except science. Unlike his contemporary society, he rejects all explanations for phenomena except those that can be demonstrated. He is tempted by bribery but heroically resists all temptations, and he also fights for people who cannot fight for themselves. He is a manager of workers who do not respect him because of his youth, yet he is intelligent and good at his job. In short, he is the way many students see themselves.

For *Pompeii*, students form teams and research one of the following topics that they must then present to the class:

- Roman aqueducts
- Volcano predictions
- History of Pompeii
- Aftermath of Vesuvius eruption
- Engineers in Roman society

The goal of the research project is clear: students must teach the rest of the class about their subject. Although the novel goes into some detail about these subjects, students need to know more about how the aqueducts work and what exactly happened to Pompeii in order to appreciate the settings and events. Students also write several smaller, individual papers about engineering ethics and how the main character's actions correspond to the code of ethics for engineers.

Michael Crichton's novel *Prey* is another action novel, this one about nanotechnology. In this novel, the main character is a computer programmer who must investigate why a swarm of nanobots has gone rogue and will not respond to their own programming. In the end, he must save humanity from this dangerous new technology. For this project, students form their own teams and choose their own projects, which have included the actual dangers of nanotechnology

(see Figure 3), how genetic algorithms work (see Figure 4,) how predator/prey programming works, real versus fiction in *Prey*, the Drexler-Smalley debate, the uncanny valley, and molecular assembly (see Figure 5). These topics are mentioned in the novel, but Crichton is writing an action novel, so he glosses over most of the technical aspects.

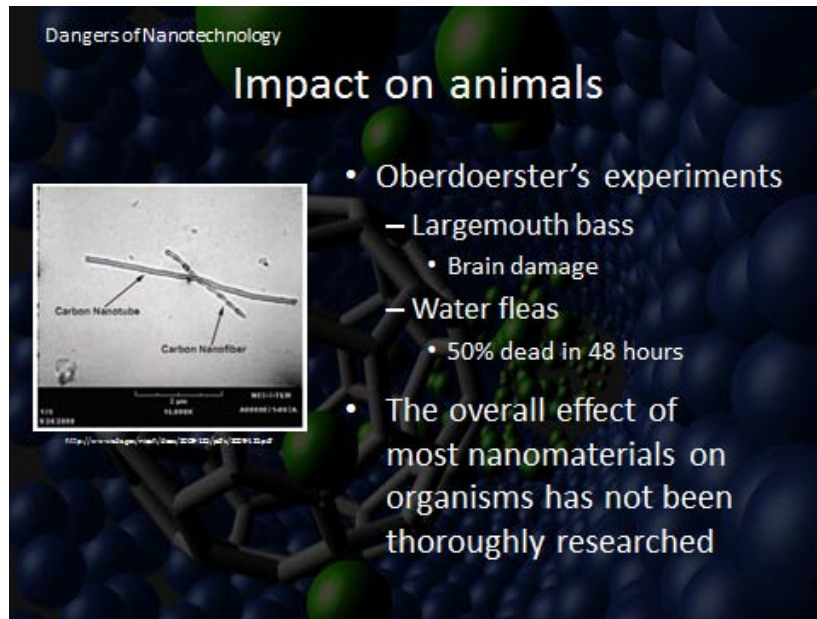


Figure 3. A PowerPoint slide example of a student group presentation on the actual dangers of nanotechnology.

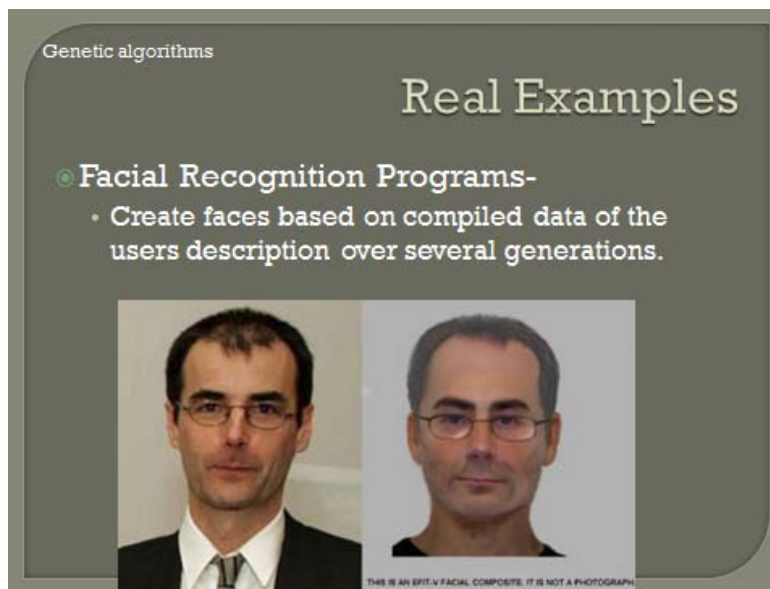


Figure 4. Another PowerPoint sample about how genetic algorithms are currently being used.

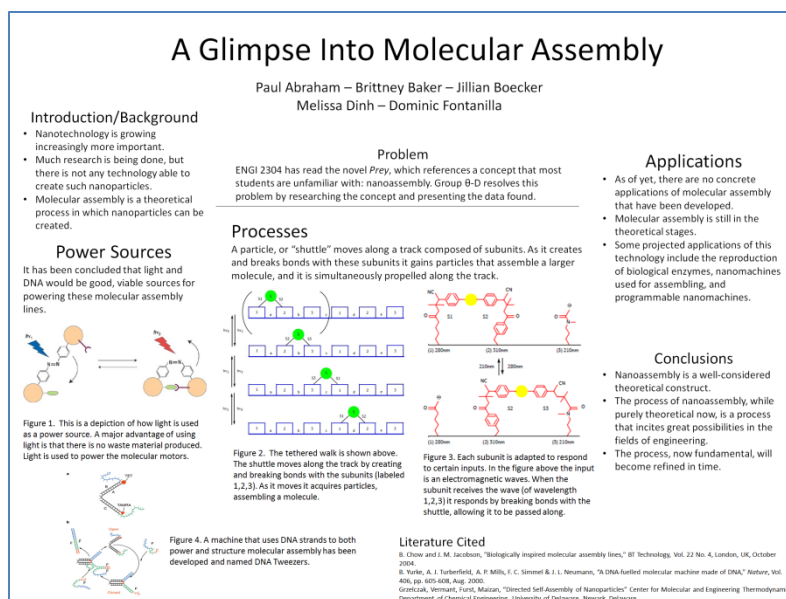


Figure 5. Sample student poster on how molecular assembly works.

Students are, therefore, exposed to contemporary engineering issues, the impact of engineering decisions, and engineering ethics. Portions of their projects demonstrate their familiarity with each of these topics.

Student Reactions to the Project

Students were surveyed (n=43) at the end of the semester using the following 18 questions:

1. State your year in college.
2. How many books do you generally read in a month?
3. List a few of your favorite books.
4. State your opinion on this statement: I enjoyed reading *Pompeii*. (Likert scale)
5. State your opinion on this statement: I enjoyed reading *Prey*. (Likert scale)
6. What I enjoyed most about *Pompeii* was...
7. What I disliked most about *Pompeii* was...
8. What I enjoyed most about *Prey* was...
9. What I disliked most about *Prey* was...
10. State your opinion on this statement: I enjoyed my topic based on *Pompeii*. (Likert scale)
11. State your opinion on this statement: I enjoyed my topic based on *Prey*. (Likert scale)

12. Describe your abilities as a technical writer after completing ENGI 2304. Do you feel confident in your abilities?
13. What was your initial reaction to reading novels in a technical writing class?
14. Describe your reactions to using novels in this technical writing class now that you have completed the course.
15. State your opinion on this statement: novels are an effective way to teach technical writing. (Likert scale)
16. What did you find effective or not effective about the use of novels in ENGI 2304?
17. What would you say to students contemplating taking this course that used novels to teach technical writing?
18. Describe how the novels were or were not effective at teaching engineering ethics.

The survey was administered anonymously through the Blackboard course management system. Students' initial reactions to reading novels (question 13) in a technical writing class were positive:

- "It made me quite happy. I like reading, so attaching a potentially boring class to good books was only a plus for me."
- "Initial reaction was that I was confused on how it would help."
- "I was glad; I was expecting to have to read chapters of the Technical Writing Handbook, and I have trouble reading dry material (as I believe everyone does)"
- "I think the idea of writing on a novel is a good idea. I enjoy reading for school because in that environment they force you to look at some work that has significance somehow. I also enjoy reading for school because I would not read otherwise. SO, when I learned we would have to actually read books that were designed for enjoyment (aka not a Classic), I was thrilled."

Students consistently wondered why novels would be used in a technical writing class, but they all liked the idea or were at least intrigued by it.

Reactions to using novels after the class was over (question 14) were also positive. One student responded that he or she strongly disagreed that novels are an effective way to teach technical communication (question 15), but his or her explanation was an emoticon (:-D), so this student

could have been joking. Later in the survey, this same student responded, “The novels did not help with the technical writing at all...It was the projects that were loosely based on the novels that helped with technical writing.” So the student saw the value in working on the projects without seeing the value in the context for those projects.

The rest of the class provided interesting, generally positive feedback, such as the following:

- “I’m glad I was in a class that let me do that.”
- “I am extremely thankful that you chose to use novels versus just bland engineering topics with no interest to the students.”
- “I like that we got to use novels and that the topics for our reports were based on the novels. I think that helped to generate a lot more interest in our projects because it related back to what we were reading.”
- “I found it to be a much more interesting class than I was expecting. In honesty, I think it helped to have such interesting source matter in coming up with the project ideas.”
- “I felt as if I understood what was meant to be placed in each section of the report and will be able to write technical papers easily having been introduced to this kind of writing, which we had not really seen before, through a medium which we were familiar with, literary works. I would recommend approaching this class in this manner rather than have students write technical papers about information they do not understand yet. I have seen students who were forced to do so, and they got so lost trying to understand what the technical terms meant and teaching themselves new material that they were unable to get past that to start writing. It is very discouraging to be given an assignment where one has to learn complex, new material, truly understand it, and write a report about it.”

The last student comment brings up one of the primary arguments for using novels in an introductory technical communications class. Students have been reading novels in high school and university English classes for many years, and they have learned how to write essays arguing about literature. Topics that are based on novels use the context that students already know—writing about literature—and introduce a new concept—the technical topic. The student is wrong about not having to learn new technical material when writing about literature, however. Even if

the context is familiar (literature), the content of the paper (the technical material) is usually unfamiliar and must be researched.

Ethics and the Impact of Engineering Decisions

Students also responded strongly to using novels to teach engineering ethics and the impact of engineering decisions. About engineering ethics (question 18), positive responses included the following:

- “I think this was an interesting approach to learn and think about engineering ethics. If we had to just discuss some of the ethical aspects by reading newspaper articles or other real incidents, while it would be informative, it wouldn't have me thinking about it too deeply. The facts would be given to me. With novels, you are forced to dig deep and think--I think that's a better approach. It also helps you critique factual incidents broadly.”
- “We learned engineering ethics by reading examples in an entertaining way. Especially after taking Human Sit [the required first-year humanities course], it helped us to analyze those ethical situations in a better way.”
- “The novels provided insight on the ethical issues in engineering as well the role of engineers in society. The novels also provided a basis for us to investigate many engineering principles.”
- “They were very effective because novels are able to present ethical situations in a way that a worksheet cannot.”
- “Novels that have a focus on engineering are very effective because they can present ethical situations that have bearing on the real world.”
- “The novels brought up the issues of ethics in an interesting fashion and made students seriously consider how these issues should be handled.”
- “When I read the stories for pleasure I became jaded because of previous knowledge I'd had concerning the topics which the novels were about. But reading the stories to analyze the situations and the ethics involved is really cool. Because you see how the situation develops from the character's perspective. It shows you that ethics are not quite so black and white. As reader you have the opportunity to look back and examine a

characters actions and see what lead up to it and how you probably would have reacted in a similar situation.”

- “The specific novels chosen gave specific situations in which engineering ethics were either qualified or challenged. They were good at showing what it looked like to be (un)ethical instead of just stating what is or is not ethical.”

Several students felt that *Pompeii* did not work that well to teach engineering ethics:

- “*Pompeii* wasn't all that helpful. *Prey* was a much better way to learn engineering ethics. However, I think a full course over Engineering Ethics would be best. *Pompeii* was too far removed from the present to learn engineering ethics. If anything, *Pompeii* was good for showing students a good working attitude: do your job, period.”
- “*Prey* was very effective. *Pompeii* was not very obvious to me at first. I discussed the book with other students before coming up with ideas. Even then, I felt more strongly about the ethical issues in *Prey* than in *Pompeii*.”

Students agreed that the novels helped them see the importance of thinking about the impact of engineering decisions:

- “*Prey* specifically showed how the abuse of future engineering technology can lead to devastating problems.”
- “Novels provide lots of context and a view into possible decisions that a lecture could not possibly provide.”
- “You could see the consequences of the action in the book, but could then contemplate what might have happened to the character if they had taken the other path or made a different choice.”
- “Showed a facet of society and situations that may have gone against ethics, thereby allowing us to witness and comment on its negative effects of a company or a community.”
- “They were effective in that students were walked through different situations and see what characters did. Depending on the author and the reasoning he gives the character an unethical decision can sound reasonable, like letting the nanobots free into the environment so they can evolve. Even though it's a bad idea. Students learn they need to

think of the consequences of their actions before carrying them out, even potential unintended ones.”

Engineering Writing

Students not only learned about engineering ethics and the impact of engineering decisions, though. They also learned about technical writing. Each student responded that he or she felt more confident in his or her technical writing abilities (question 12). Three students specifically mentioned that they learned the conventions of engineering or technical writing, although one student commented that he or she would have to consult the textbook in the future to make sure the correct conventions were followed. Several students mentioned writing they had to do in other classes, such as this one:

I am definitely confident about technical writing. After taking the class, I know what I'm required [to do for] assignments in other classes. I had two other projects in physics and engineering statistics this semester and I did very good in them because of this class. I am also able to critique and recognize whether other technical documents are credible enough to use in a research paper. I know how to fully utilize the library resources. I will also be more confident making presentations in the future.

Conclusion and Recommendations

The course goals were met. Students learned how to write about and present technical material, but they also learned about engineering ethics and the impact of engineering decisions.

A few changes will be made to the curriculum, however. One student's thoughtful response helps explain these changes:

I believe the novels were an adequate method of teaching us about issues of engineering ethics. However, I believe that because these novels are fictitious, our learning of engineering ethics should be complimented by real world examples of when ethics come into play (Like examining Intel's Pentium chip incident, for example). Additionally, my learning of technical writing was not reinforced by

either reading the novel or doing the response journals associated with them. The entirety of my learning came from writing the proposals/ reports, looking over reports online, and using the Finkelstein book while I worked. However, the novels were very enjoyable and it wasn't a hassle to read them, unlike in Human Sit [the required first-year humanities course for all students in the Honors College]. The novels also give the entire class a context - Our report topics come from the novel, we learn more about the issues mentioned in Prey and expand on them through our presentations, and learn about new and fascinating subjects. I can imagine this class would not nearly be as interesting as it was had we not read the novels.

First, this student enjoyed reading the novels. He or she says that they are “enjoyable,” and that the class would not be as “interesting as it was had we not read the novels.” This same student then responded that he or she would recommend this version of the class to friends: “This class is fun and practical. You will understand technical writing thoroughly, and, because of the novels, you will learn more about engineering in this class than you would have thought.”

However, the student mentions that the “learning” came from writing the reports and using the course textbook. This student, again, does not see the point in the context for the reports, similar to the student mentioned previously. This student does, however, agree that the novels were fun and interesting, pointing out the disconnection between his two responses. The student is suggesting that the learning of engineering communication conventions is separate from the topic used for learning those conventions, the same point made earlier that ENGI 2304 is naturally a course without content. Using novels in the class is an attempt to bridge that gap between the content and the learning of communication conventions by providing a class context and a purpose for writing. Two students out of 43 mentioned that they did not see the value in this bridge.

This student’s comment about the use of real-world examples is insightful. The student suggests that attempts to teach engineering ethics should make use of real-world examples, and that fictional examples are inherently lacking in teaching real-world students about real-world issues. The student doesn’t state why fictional examples do not work, however. He merely says that

real-world examples should be used to “complement” the fictional examples. Future versions of the course will incorporate several examples of actual ethical situations surrounding nanotechnology or another novel’s topic.

In addition, *Pompeii* by Robert Harris will not be used again. As one student mentioned, the subject matter is too far removed from everyday life, and the topics on engineers in Roman society and the history of Pompeii are not as technical as they should be. Another novel that combines technical content with an exciting, engaging story will be used instead. Possibilities include Patrick Larkin’s Covert One novel (a Robert Ludlum series) *The Lazarus Vendetta*¹⁰ about eco-terrorists and the use of nanotechnology to destroy the world or Greg Bear’s *Blood Music*¹¹ about cellular computers that spread like a plague. Finding appropriate novels is difficult, however, for each possibility must include technical content or at least encourage students to research technical material. An additional problem with novels like these is that the protagonists are usually white males. I will continue to search for novels that include more ethnic and gender diversity.

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