Science and Science Fiction: Methods for Evaluating Interdisciplinary and Intermedia Assignments

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Supplementing classroom instruction with online materials and learning activities is becoming less avant-garde and more of an expectation for faculty members in higher education. The use of Blackboard, WebCT, or proprietary software, like Georgia Institute of Technology's Sakai installation (T-Square), has become a requirement, rather than an option. Citing both Project Tomorrow's "Speak Up 2008" report and "Visions 2020.2," a report based on a survey sponsored by the U.S. Department of Commerce, the Department of Education, and NetDay, a nonprofit organization in California, the *Chronicle of Higher Education* concluded in their "The College of 2020: Students" report that the students of 2020 "are restless with the traditional forms of learning and eager to incorporate into their educations the electronic tools that have become omnipresent in their lives: their smartphones, laptop computers, iPods, and MP3 players (Van Der Werf and Sabatier 7). Faculty intent on reaching such students must devise nuanced methods of course delivery and revise course assignments to more comprehensively account for these shifting paradigms. As these alterations are made, faculty must also devise new systems of evaluating student work when it reaches beyond the discipline-specific learning outcomes to include technical writing and digital design components. In constructing an interdisciplinary course on the intersections between science and science fiction at Embry-Riddle Aeronautical

University, one of my goals was to create assignments that challenged students' technical

prowess, as well as their skills with writing and critical analysis. Requiring students to learn or

improve upon their HTML skills by developing webpages, rather than traditional essay

assignments, allowed me to more easily convey the idea of technical languages as having their

own rhetorical principles. The complexity of the projects required a staged evaluation process

that ultimately challenged students to work far beyond the assignment "requirements," as they

began to truly explore the boundaries between different modes of discourse.[1]

Developing an Interdisciplinary Course for Studying Science Fiction

The upper-level humanities course, Traversing the Borders: Science and Science Fiction,

fills a type of experimental niche at Embry-Riddle by instructing students in interdisciplinary

research through the overlapping fields of scientific inquiry and fantastical fiction that at times

informs or draws upon the actual scientific endeavors students are pursuing. The discipline-

specific learning outcome from the university outline that is unique to this course states that

students should be able to "conduct primary and secondary research focused on a single reality-

altering event, gathering, analyzing, and interpreting information generated from a variety of

traditional disciplines and integrative professions." The events chosen by the students may be as

varied as science fictional accounts of extra-terrestrials to scientific projects developing space

elevators or eBooks. Beginning the semester with space exploration in science fiction, I find the

apparent diversity of my students' interests in their approaches to Jules Verne's *From the Earth

to the Moon* or Joe Haldeman's *The Forever War.* To further challenge students in

interdisciplinary work and thought, the course requires that they compose websites in HTML

with hyperlinks or superscripted footnotes for outside research. These alternative writing

assignments, which allow a certain freedom of direction, cover topics as varied as political satire,

the physics described in a novel to support spacecraft being developed, and the societal issues

faced by different characters in futuristic settings. Students' interests range from the sciences to

the social sciences to the humanities. My goal is to guide the students to different research

methods that will reveal the intersections between the fiction and the narrative discourses that

occur outside that fiction in our own scientific disciplines and historical observations, while also

teaching students to compile that research in new and interesting ways that support an original

viewpoint.

This approach to interdisciplinary learning and research works especially well with

projects that utilize hypertext references, embedded images and videos, and other web based

design components. In her article on interdisciplinary pedagogy, Nowacek comes to understand

interdisciplinary thought as "the shift from a recognition of the coexistence of multiple but

apparently independent activity systems to an awareness of the overlap and interanimation of

those activity systems" (495). What better example of the overlap of these systems than Gibson's

Neuromancer and the computer terminology that was birthed in that novel before the Internet or

"cyberspace" came into existence. And how better to compose nuanced writing on such a work

than through a markup language, like HTML, that requires students to understand a real

computer language and use it to display a comprehensive compilation of research that could be

used to convey a student's perspective on cyber-terrorism or advancements in artificial

intelligence. Nowacek goes on to call interdisciplinary studies "a type of abnormal discourse that

can empower individuals in limited but powerful ways by making visible previously invisible

connections and constraints, even as it may obscure others" (496). In exposing these invisible

connections through our study of science fiction texts that posit discoveries we have seen come

to fruition and in teaching the HyperText Markup Language of the Internet, I intend to empower

students to uncover the connections that may be obscured, from faulty observations and theories

to possibilities for scientific inquiry that are still unmade. At a technical institution like Embry-

Riddle, such obfuscations need to be researched, understood, and overcome by students pursuing

research in fields that require a certain degree of imagination blended with pragmatism. An

aerospace engineer must be able to apply methodology, while also upending it when necessary to

create new processes to meet new engineering problems and designs.

HyperText Markup Language for Writing and Research Projects

Having students submit projects in HTML was a vital part of the course's

interdisciplinary aims (see Appendix 1). While there are some limitations to the amount of

instructional time that may be spent in highly technical areas for a class as broad as this one,

most students have some familiarity with a simple markup language like HTML, if from no other

source than social networks or blogs. To feel more proficient in the area, I purchased my own

HTML handbook and then experimented in Notepad with different concepts from the book. Like

my students, I ultimately found it easier to Google how-to directions for certain complex tasks

than locating them in the guide, but the guide was useful as a refresher on setting up a page. I

worked with my university's IT Department to procure a faculty webpage and learn how to use

the SSH Client required to transfer files to a university supported web page.

Once I felt proficient with basic HTML coding, I found that supplementing my course with simple instructions for creating a generic HTML document did not take an excessive amount of time away from instruction but did offer students a foundation for composing in a technical language that could give them additional insight to the technical fields they were researching for the class. Heba explains how, "By coding documents electronically, we are not just ensuring that the information we are presenting online is accurate, concise, and clear, but when using markup languages, we are also, in a metaphorical sense, 'teaching' our computers to communicate with one another through these languages" (277). Students in my science fiction class were constantly engaged with a new language, one being deconstructed in the novels they read and the classroom discussions on everything from Turing machines to the manipulation of cyberspace by punk hackers. In requiring students to use a markup language, like HTML, to complete their projects, I was attempting to engage them in an analysis of the language behind the websites they view on a daily basis to more accurately understand the complexity of computer speak.

Each of the three major assignments for the class required students to research a sub-topic related to one of the three focal areas of the novels from class (space exploration, computing technologies, and nanotechnology) and compose a webpage or website exploring that topic in fiction and reality. Students were given a general prompt for the assignment to guide them through topic selection, organization, research, and formatting concerns and a basic guide to the HTML components required for the assignment. The HTML guidelines instructed students on how to create an HTML document in a text editing program; open and close the HTML on the page; set up a running title, heading, and subheadings for the page; format paragraphs; create

hyperlinks; make footnotes; format an attribution to the student as author; and troubleshoot for any problem punctuation marks or errors in spacing after the page is completed. In addition to these basic directions, I set up a discussion board forum on the class Blackboard page with threads covering a variety of optional HTML choices, including background color, tables, headings, aligning text and images, embedding images and video from online or from a student's personal computer, color tags, and background sound. I left the discussion board open for students to post their own advice. One student from the Honors program who required additional coursework created her own PowerPoint explaining how to use HTML to make a multi-page website and posted it on the discussion board. Another student shared a free website that offers a split screen text editor to show the HTML and the website composition simultaneously. Other students used the discussion board to post questions and offer assistance to one another, creating a strong learning community. My initial concern that I was asking for too much in these projects was allayed by the overly ambitious projects that students completed. I found myself contending with computer programming majors who wanted to incorporate their own homemade style sheets or Java scripts into their pages. Despite my own limitations in those areas, I found their work fascinating and learned from the students, as well.

Before the evaluation process commenced, students completed an in-class topic discovery assignment, a hard copy of a rough draft for general comments on organization and writing, and a final draft that they uploaded in a file or folder format to the class Blackboard assignment page.

Summative Evaluation Methods

The complex nature of the web projects students completed for this course required a new evaluative method that would assess students' performance in multiple areas, including writing, research, and web design. The first evaluative tool I developed was a summative evaluation rubric to correspond with the course learning outcomes and my expectations of the students' writing and research skills from the course instruction. A summative evaluation, for this course, is defined as the final evaluation of a student's work with an attached score after which no further revisions are permitted. The only exception to this rule was the permission I gave to students to submit any post-evaluation revisions by the end of the semester before the webpages were published on the class website for the general public to view. These alterations did not affect a student's score on the assignment. Developing the summative evaluation was important to complete before deciding upon formative evaluations that would be used to guide students toward the final evaluation of their work. In creating three major projects with the same summative evaluation measures, I considered the first two projects to also work as a type of formative evaluation, in that students could apply any criticism received towards the remaining project(s). These summative evaluations covered six areas that were crucial to the types of learning outcomes students should achieve in an upper level humanities course that fulfills an interdisciplinary research goal: selecting a project topic that makes innovative connections between a topic covered by the science fiction and that same area of inquiry in the "real world," fully developing supporting details that explain the connections being made, choosing appropriate sources for hyperlinks or endnotes that fill in parts of your discussion, organizing ideas clearly in a cohesive and coherent manner, avoiding grammatical and spelling mistakes,

and formatting the page design to make it easy to read and aesthetically pleasing. The topic

selection and choice of supporting details counted for ten points more than the other categories,

which all counted equally toward developing a final evaluative score on the project. The areas

were each described in a simple analytic grading rubric with four columns for each of the six

areas (See Appendix 2).

Not only do students have to demonstrate their understanding of the content in the course

by applying it to a new topic of their choosing, but they're also having to demonstrate an

understanding and application of web design and coding techniques that some students may not

have encountered prior to entering the course. Evaluating students' performance in these areas is

especially difficult, given that some students may have demonstrably advanced websites, due to

prior experience with HTML, but poor writing skills, while other students may write excellent

studies on a topic with strong research materials, but demonstrate limited understanding of

displaying that information in an interesting format on their webpage. To round off the challenge

of evaluation, students are demonstrating their analytical skills of the component parts within

their topic, their writing skills in conveying information, and their research skills in comprising a

list of strong links to illustrate components on their page.

The evaluative methods begin with a student's ability to discover and present research on

a topic that could be considered compelling to an online audience. In *The Rhetoric of Cool,* Rice

examines the ways in which "digital culture" and its "rhetorical moves" "challenge and disrupt

print-oriented conventions and structural logic" (21). By drawing upon "post-World War II

American culture, a culture largely shaped by an emerging electronic apparatus based on

television, film, the transistor radio, and, of course, the computer," Rice concludes that "[t]he

figures [he] draw[s] upon could not have produced the rhetorical work they did within any other

kind of apparatus; their work is technologically fashioned by implicit and explicit forces" (21).

Technology and culture are indeed interacting to produce a new stream of narrative with its own

unique rhetorical challenges. Students in the class needed to demonstrate an understanding of

this new stream of narrative in their projects and were evaluated, in part, on whether they

successfully performed in this area. For example, a student describing two authors of science

fiction (George Lucas and Jules Verne) and a seemingly unrelated piece of aerospace technology

(missile defense systems that use lasers), simply because there were lasers in the *Star Wars*

films, failed in the summative evaluation to have produced the kind of compelling narrative that

a website permits a user to create. That project seemed to have three disjointed focal points that

were under-developed without clear connections in the writing or research that would offer a

digitally enhanced understanding of the content. However, a successful project titled "Come Sail

Away," made interesting connections between the development of space sails and the historical

concept of sailing as exploratory in Verne's own lifetime. That particular project drew on literary

and historical research in sailing, as well as scientific research on new technology that may be

able to harness solar energy for momentum in the vacuum of space with fascinating images and

hyperlinks to broaden a viewer's understanding of both the topic and its inter-connectedness to

themes in literature and historical conceptions of sailing. Students who were evaluated "in the

middle" in this area tended to offer more direct comparisons without delving into the

significance of the need for the technology, the ethics behind it, or its historical relevancy. For

example, a mediocre project explained what a Gundam was in Japanese Animation and then

proceeded to show different Gundam-like technologies being used by militaries. Even though the

topic is narrow and the connections are well-developed, this project appeared more like a report

or encyclopedic entry than an intellectual discussion of such technological uses. To make a

comparison to current websites, this report offered more of a Wikipedia approach to a topic with

a survey of information and links to outside sources. Those types of web presentations are

extremely useful and educational, but they do not require the level of creativity or critical

thinking about the topic that this project was to have achieved through an evaluation of that

material, rather than a compilation of the material. In fact, one of the five pillars of Wikipedia is

to have a neutral point of view in the presentation of information, which disrupts print-oriented

conventions by allowing users to edit and by offering hypertext connections but does not offer

the single-user the ability to offer an original and possibly disruptive narrative perspective. In the

case of these examples, the portion of the webpage that made a project "most compelling" was

the student's analysis of the topic and research. Analysis requires a student to engage with the

topic and make a nuanced argument about that topic.

The summative evaluation also included the students' use of interdisciplinary research

through hyperlinked and/or notated sources provided on the webpage. Greene from The Campus

Computing Project explains, "Over the past three decades, technology has transformed the kinds

of content—elements of the knowledge base—that inform professionals. It has also transformed

core notions about access to the content" (5). Greene goes on to show how this transformation

has "*expanded and enhanced* the research methodologies that inform the professions and

professional practice," "*transformed* the way we convey that knowledge, from the traditional text

formats to simulations and visual learning," and "*facilitated* access to the content—the

knowledge base of professional practice—via digital content and the Internet" (5). Students have

the misfortune, in many cases, of entering this enhanced digital research field without the skills

necessary to determine the efficacy of different types of information for different sorts of

academic work. The projects in this upper-level, interdisciplinary science fiction course

challenged students to rhetorically analyze the sources they found and use the ones they deemed

most reputable from their analysis. For example, a student writing on transistor computers linked

to an ongoing project in the Computer Science Department at the University of Manchester, thus

giving further reading on research in that field to viewers of his website. Other links to the

Department of Energy or NASA would also give more rhetorical ethos to a student's work than

links to Wikipedia or the Internet Movie Database, regardless of the validity of the specific pages

being linked. Students were aiming for the website to look somewhat scholarly, yet they were

still allowed a certain degree of freedom to play with digital sources outside traditional

scholarship to make their websites interactive and engaging. One student managed to find a free

online program to generate his own Hal 9000 from *2001: A Space Odyssey* for a subsidiary page

on a website exploring artificial intelligence.

The uses of embedded materials and direct links to other websites also require that

students' design elements be evaluated. Web projects have their own inherent challenges when it

comes to readability and clarity. Students must consider font colors and styles, hyperlink colors,

text and image alignment, and contrasting background images or colors when developing

websites. To make the page work aesthetically, many students employed tables and borders for

text and images to give their websites a clearer and more professional appearance (see Appendix

3). Some students also created their own navigational buttons that needed to have appropriately

contrasting colors or images to make them readable and user-friendly. Students most often

scored poorly in this area when the page was illegible or when images and/or videos were

haphazardly represented throughout the page without bylines or spacing before and after the text

portions, frequently left-aligned to leave a lot of blank space on the page. Most errors in this

category were corrected by the second project, and the third project had few, if any, blatant

design errors. Rice argues, after describing how Plato's *Gorgias* reveals rhetoric to be

mechanical, not ethical, "embracing the role of technology's mechanics is necessary for those of

us who want to serve as rhetorical producers and teachers of production in the twenty-first

century" (368). Rice finds that many academics still have negative attitudes toward the role of

technology and, therefore, proposes "that we conceptualize rhetorical producers as *logo*

mechanics, or creators who can imagine, improvise, and enact the material deployments of

meaning and its operation" (372). In designing their webpages, students in this course needed to

understand the mechanics of their rhetoric on two different levels: the level of language and

design presentation. Many students chose designs to specifically enhance the rhetoric of their

page through neo tech fonts or running displays of binary code in the background.

Formative Evaluation Methods

In developing formative means of evaluating student work for the major web projects, I

considered how best to require students to complete the type of freewriting that best permits an

exploration of ideas and the drafting that offers them the kind of time and feedback necessary to

improve upon design, organization, and writing technique. Formative evaluations consist of the

feedback given to students that is intended to aid students in improving their skills and

performance prior to a summative evaluation of their work. Such evaluations further a student's

ability to self-regulate his or her learning and be more proactive in achieving learning outcomes,

as can be seen in Nicol and MacFarlane's "Formative Assessment and Self-Regulated Learning:

A Model and Seven Principles of Good Feedback Practice." This description of formative

evaluation by Calfee and Miller gives a compelling outline of the philosophy behind such

evaluative methods in the composition classroom:

> Formative evaluation entails relatively informal procedures for obtaining
>
> information that can guide improvement in student learning. The primary goal in
>
> the classroom setting is to establish the degree to which the student is making
>
> progress—and, if he or she is not, to find out how to help the student begin to
>
> move ahead. . .Formative evaluation searches for the conditions that support
>
> success, which can include helpful advice from the teacher, can also open the way
>
> to explore interest and motivation, opportunities to cooperate, and various
>
> accommodations. . .Formative evaluation is richly qualitative, creating portraits
>
> that can be viewed from different perspectives. (274)

In keeping with these principles, I gave content evaluations of students' freewriting activities and

comprehensive evaluations of content, proposed design, and writing technique for drafts of

student projects. Each of the readings from the science fiction in the course was accompanied by

a required written response that allowed students the opportunity to consider the connections that

they would need to use for their projects. These responses also required students, at times, to

come up with a source that would back up their suppositions. Other times, they were asked to

consider the "big ideas," like the overabundance of Eastern philosophy and culture in certain

works or the move toward globalization presumed by the novels. Through these writings, which

were evaluated simply on a pass/fail basis with full credit given to any attempt that met the length requirement and indicated the student had completed the assigned reading, students were given a "safe" environment in which to experiment with their suppositions without earning grade deductions for attempts that did not work well. My handwritten or typed responses would give them follow-up questions, indicate especially sophisticated lines of inquiry, or correct any misunderstandings from the more challenging literary works.

In addition to these responsive writings, students completed a draft document of their proposed web project before coding the web projects for the course. This draft was assigned after a lengthy discussion of the guidelines for each project that included a discussion of the summative evaluation rubric and, in the second year the course was offered, a review of the more successful web projects from prior students. One of the challenges of assigning projects in a mark-up language is that revision within the document is more challenging than revision to a document in a word processing program because the language signifying everything from paragraph breaks to changes in font style exist in HTML codes alongside the text. Adding HTML for hypertext and embedded materials presents further challenges in editing such material. Draft documents were therefore presented as hard copies of what the student intended to represent on the website he or she was developing. Students submitted drafts in a variety of formats, from print documents with images embedded and sources written to the side of where they would appear in the text to poster presentations of how multiple webpages for a website would appear. Huot and Perry studied the use of formative evaluation for writing courses and came to the conclusion that they work best when students are actively involved in the discussions about what makes a project more successful and why. In their conclusion on the value of

formative evaluation, Huot and Perry state, "Students not only learn that audience and purpose are important, but they also come to realize that only by assigning and then assessing the value of such rhetorical components can they reach their overall goals as writers. For example, each writing assignment introduced in class should also contain a discussion of what makes a good assignment of this type" (427). Successful assignments must therefore encourage students to engage in the discussion of the assignment itself and the rhetorical strengths or weaknesses of possible writing for those assignments. In the science fiction course, students submitted proposal documents that could be modified digitally or by hand to indicate where hypertext or images would be inserted and to show what those insertions were. Each of these proposals was given a more intensive evaluation than the final projects to let students know where improvements could be made in writing, research, and, when apparent, design/formatting. Like the responsive writings, these proposals were treated as a "safe assignment" with a point value given to how complete they were, rather than how good they were. Occasionally, such proposals were met with the suggestion to start over when the selected topic did not match the assignment by being off-topic or too generalized. Students most benefited from the markings indicating organizational or grammatical mistakes that would be much more difficult to change in the text document, since they were composed using HTML code in a text editor.

One of the drawbacks from this formative evaluation process is that it does not provide students with a formative evaluation of the complete project in HTML on a web browser. In the course this leads to several limitations, especially for the students entering the course without any background in HTML. In spite of the strong writing and website concepts, certain students struggled to deliver the project they wanted because of challenges with creating, modifying, and

uploading the HTML document. Students using Macintosh computers for the project

encountered difficulties with changing the file extension, which required an extra step for some

users because the text editing program they were using consisted of a rich text format that needed

to be converted to plain text before the file extension could be successfully changed. Other

students struggled with HTML choices that accidentally made the screen text require horizontal

scrolling or showed alignments differently when the page was opened on different computers.

Many of these problems could not be seen until after the final project was uploaded and viewed

on different computers. To alleviate the stress that such problems caused for students, especially

the ones who felt intimidated by their peers' experience with HTML prior to the class, I worked

with students to overcome these challenges. Following the first project, any student who found

their uploaded document did not work properly on different computers or had unexpected errors

after the upload were allowed to request permission for resubmission. Their initial attempt was

cleared from Blackboard and a new attempt could be uploaded. Following the summative

evaluation of projects, students who could show me how they had erred in the HTML on their

document, causing a score reduction for malfunctioning hypertext and poor design, were allowed

to correct such errors for a partial score increase. These errors had to do mostly with spacing

problems in the HTML or the use of quotation marks or apostrophes that were not in the correct

tick mark format. I continued to allow such exceptions with the second project for students who

were experimenting with more advanced HTML techniques than the ones employed in their first

project. In this way, students acquired and built upon their skills with the mark-up language

while producing more sophisticated projects as the semester progressed. Students' third projects

on nanotechnology showcase their progression from the first projects by offering more

sophisticated and professional websites.

Ultimately, the point values received during the summative evaluations, combined with

the opportunity for corrections in areas not explored by the formative draft evaluation became

instructive to students working on subsequent projects in the class. Students frequently respond

more to a point deduction on a major assignment than an evaluative comment on a draft. As

Covic and Jones discovered in their experimental introduction of a formative evaluation process,

". . . while many of the students welcomed and used the resubmission option, more than half of

those who utilized it did so because they failed the first submitted essay" (82). Their conclusions,

based upon student feedback and results, regarding this increased failure rate for the psychology

course section offering a formative evaluation was that "for a number of students the

resubmission option was viewed as a 'safety net' rather than an opportunity to learn and apply

that knowledge to improving the essay through resubmission" (82). While students may benefit

from formative evaluations, educators must be aware that work produced in the formative stage

will frequently not be up to the student's performance level for an assignment receiving a

summative evaluation. Not one draft submitted for formative evaluation in the Science Fiction

course was near completion, and many still needed significant work after being submitted for the

summative evaluation. Most of this work lay in the students' ability to troubleshoot the HTML

portions of their projects after seeing the projects on multiple computers before and after

uploading it to the class Blackboard site. Students were able to progress from the first project to

the second and third projects by building upon the knowledge gained by their earlier mistakes

and corrections in the coding of the websites. In this way, even the summative evaluations were

able to serve as learning tools for later course projects. Students did not simply learn to correct errors, but they also learned to employ more complex design elements as they mastered the simpler techniques earlier in the semester. Finally, students were encouraged to submit updated versions of their projects before the end of the semester when I published their web pages on a website created to display the course projects. However, consistent with the research, only a couple of students from each semester submitted revisions of their projects, most likely because these revisions would not affect their course grade.

Conclusion

Through these projects and their evaluation methods, I have strived to consider what O'Gorman calls hypericonomy, as a "hypothetical method for testing how scholarship might be transformed by new media and new theories of discourse" (95). In this way, the scholarship students produce in the class reaches a kind of singularity, in which they are simultaneously constructing new ideas and presenting them in a creative way, combining images and scenes from films that inspire them with hyperlinks to equally inspirational research being done by scientists and scholars in various fields. Students in the course were able to engage in a new language through HTML coding, merge together online research from multiple disciplines, and create a new narrative of their own for the way science and science fiction overlap in their purported aims. When writing on utopias, Jameson locates an opposition, in terms of subjectivity, "between consciousness—as an impersonal presence to the world which is always with us as long as we exist—and the self, which is so often an object of consciousness, but also of biography and its stories, of fantasy and trauma, of 'personal' ambitions and private life, in

short of narrative as such" (213). Students are becoming more self-directed in their learning and

must, therefore, develop more self-reflective means of narrating the various discourses that make

up their own personal narratives. Educators would do well to offer students this opportunity to

transform their research by developing courses that expose multiple layers of meaning in various

spheres of knowledge, including the digital world, and by assigning and evaluating student work

in a way that permits those students to more fully participate in the creation of their own socio-

cultural identities within a vast network of students and scholars.

Appendix 1

Excerpted example of HTML code for website displayed in Appendix 3

```
<html><head><title>Nanotechnology: An Illustrated
Primer</title></head>
<body leftmargin="40" rightmargin="40" link="990000"
vlink="990000" background="mediatronic background.jpeg"
bgproperties="fixed"><center><table width="900"
bordercolor="FFFFFF" frame="void"><tr><td>
<center><table bordercolor="000000"><tr><td><table border="5"
bordercolor="000000"><tr><td><font color="000000" face="century
schoolbook" size="8"> Nanotechnology: An Illustrated
Primer</tr></td></table></tr></td></table></center>
<p><font size="5" align="left"><u>Nanotechnology Gets a Bad
Rap</u></font></p>
<p><table border="5" bordercolor="000000" bgcolor="FFFFFF"
cellpadding="10"><tr><td><font size="4" align="justify">
<i>Nanotechnology.</i>  The word rings with science fictional
connotation; fears arise of a nano-robotic revolution, a world
shrouded in <i>"grey goo,"</i>or the technologically aided
evolution of the human species beyond what we consider actually
human.  Science fiction works with scientifically conceivable
technologies on the horizon of development, or occasionally,
technologies that have not yet been conceived by science, and
forecasts the possible outcomes, often negative.  A strong theme
in science fiction is unforeseen negative consequences, often
apocalyptic, of actions carried out without thorough thinking.
Examples of this theme show through in stories such as <a
href="http://jerz.setonhill.edu/resources/RUR/index.html"
target="blank"> Karel Capek's "R.U.R." (1921)</a> or <a
href="http://bestsciencefictionstories.com/2008/02/24/blood-
music-by-greg-bear/" target="blank">Greg Bear's "Blood Music"
(1983)</a>.</p>
<p>In "R.U.R.," a love-struck working man unthinkingly bestows
the Rossum company's robots with sentience and emotions to please
the woman he loves.  This causes the robots to become aware of
their oppression, become enraged, rise up, and slay the entire
human race, intending to take over.</p>
<p>In "Blood Music," a scientist develops a species of
reparative, medically inclined nanobots, which he experimentally
introduces into his own system, his only intention to make
himself <i>better</i>.  The nanobots are programmed to
communicate and work together, and from this they appear to
attain some level of autonomy.  They certainly exhibit
consciousness, considering themselves a self-directing
"universe."  Their consciousness, in time, becomes stronger than
that of their host, and they take over both his mind and body,
proceeding afterward onto others until they have claimed the
whole world.  Everyone and everything is transformed,
essentially, into what is identified in science fiction as <a
href="http://www.nytimes.com/2003/12/14/magazine/14GRAY.html"
target="blank">"grey goo"</a>.</p> . . .
```
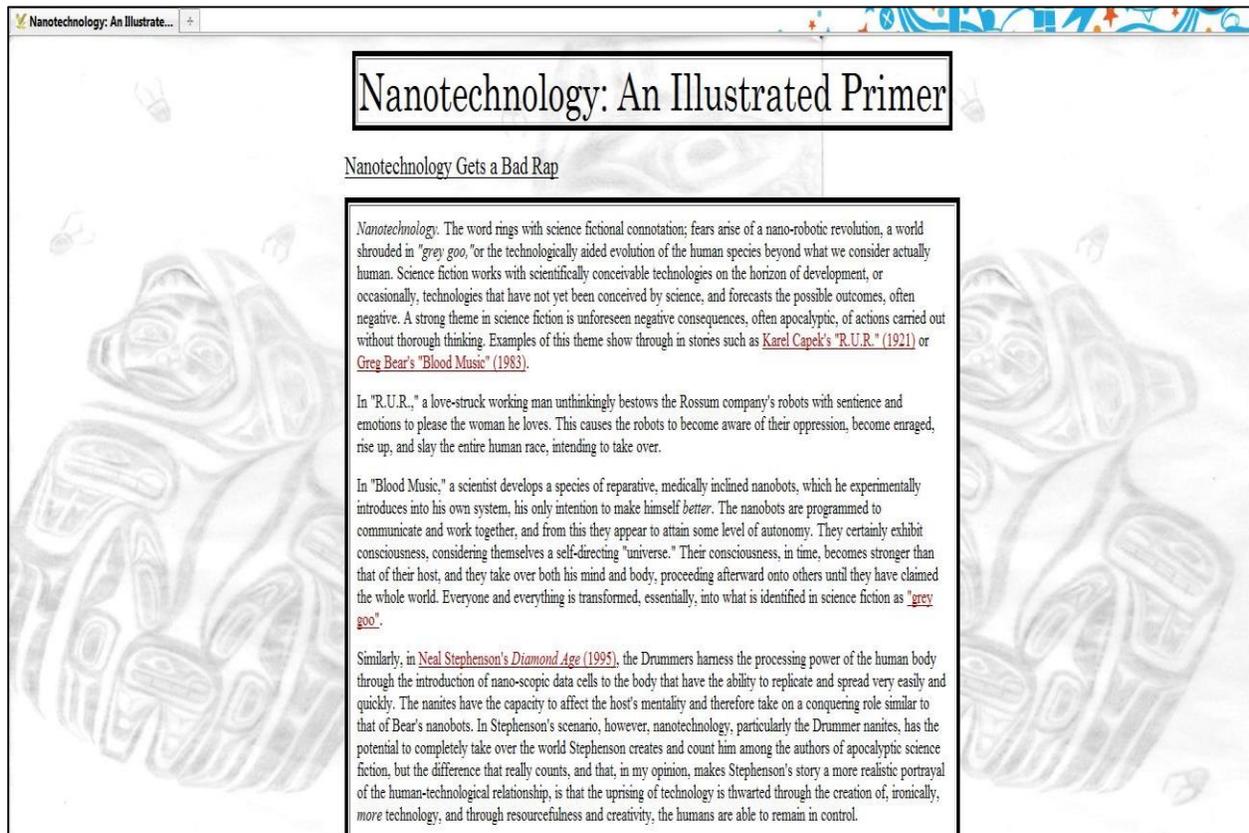
Appendix 2

Multimedia Project Evaluation Rubric: Science and Science Fiction

CATEGORY				
Focus on topic	Student chose a challenging topic related to the portion of the course for this project. Student makes compelling connections between fiction and practical applications.	Student chose a relevant topic. Connections made are interesting, but fairly predictable.	Student chose a relevant topic. Connections are not made clearly between the fiction and the practical applications.	Student chose a topic that does not relate to this portion of the course.
Supporting details	Student supports connections between fiction and practical applications with compelling details and fully developed explanations.	One or two supporting details are not fully developed to convey the relationship between fiction and practical applications.	Supporting details are relevant, but need to be more fully developed throughout the page.	There are insufficient supporting details, or the supporting details are severely under-developed.

Hyperlinked Information	Student provides quality hyperlinks to pages that aid the reader in understanding the material being discussed on the page.	Most hyperlinks aid the reader in understanding the material, but some hyperlinks appear to be unnecessary or superfluous.	Student uses too few or too many hyperlinks, making the page sparsely developed or confusing.	Hyperlinks do not appear to contribute to the student's work or do not function in the completed text page.
Organization	Student organizes material into well-developed block paragraphs that are easy to follow. Paragraphs are cohesive and coherence.	Most paragraphs are well-developed, one or two lack cohesion or coherence.	Paragraphs appear to have been organized haphazardly and attempt to cover too many points. Paragraphs lack cohesion and/or coherence.	Student did not attempt to organize material into paragraphs. Page consists of one or two long paragraphs.
Grammar	Writer makes few, if any, grammatical or spelling errors.	Writer makes some grammatical or spelling errors, but they are not repetitive and do not interfere with meaning.	Writer makes several grammatical or spelling errors. Some are repetitive and make the meaning difficult to grasp.	Student should consult a writing center tutor for help with grammatical or spelling errors that occur far too frequently and make the writing difficult to understand.

Formatting	The document is formatted according to the guidelines covered in class. Html tags all function correctly when the document is opened as a web page.	The document is formatted correctly with one or two minor errors. Student may have added formatting that makes the page difficult to view because of layout choices.	There are several problems with formatting that make the page difficult to view.	The formatting is full of errors. Page may only be viewed as .txt file.

Appendix 3

Screen Capture of a Student's Well-formatted Web Page

Notes

[1] For an example of the work produced by students in the spring of 2012, see the class website:

http://webfac.db.erau.edu/~andrewsa/sci_fi_main_page_index_spring2012.html

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