AC 2012-4066: INTEGRATING INFORMATION LITERACY IN ENGINEERING: LIBRARIANS/FACULTY

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Integrating Information Literacy in Engineering: Librarians/Faculty Collaboration for the First Year Engineering Experience

Introduction

For the past three years, the University Libraries and the Provost's Office at West Virginia University (WVU) have combined funds to provide grants to professors wanting to enhance their courses with information literacy components. In 2011, the Assistant Dean for Freshman Experience in the College of Engineering & Mineral Resources applied for and received a grant to enhance Engineering 101, the main freshman engineering course taught mostly in the fall. This was the first time that multiple sections with hundreds of students would be served by one of these grants. Normally the teaching team consisted of one professor and one librarian. Since it was possible that there would be 500-700 students in at least 14 sections, it was apparent that this model would not work. So, two engineering librarians teamed up with the group of instructors to provide library information modules for the course.

Technical writing is an essential skill for developing and practicing engineers. Engineering 101 is a freshman-level engineering problem-solving course at WVU which requires students to write at least two technical reports. Past experience indicates that students typically have difficulty understanding the function and content of the parts of a technical report, defining and avoiding plagiarism, evaluating the validity and veracity of online sources, and finding appropriate sources to use in research background information on an assigned topic. The collaboration between the librarians and engineering instructors focused on addressing these issues.

Literature Review

The librarians did a literature search and called for assistance from various listservs. Enough relevant responses were received to help aim them in the right direction. They used the ideas from papers and websites to develop the information and test questions for each module. Specifically, they wanted to look at different aspects of the teaching: the audience and more specific freshman engineering students. Mittermeyer[1] and Combes & Anderson[2] looked at freshman and information literacy and different aspects of teaching to them. Articles by Amekudzi et al[3], Andrews & Patil[4], Brush[5], Nerz[6], Popescu & Popescu[7], Roberts & Bhatt[8], Stitz[9] and Weiner[10] discussed teaching to engineering students. Several emphasized the importance of interaction in class. Leishman[11] and McGuinness[12] provided interesting insight into faculty and librarian collaboration.

In her 2011 article, "Are They Learning? Are We? Learning Outcomes and the Academic Library", Oakleaf[13] examined different information literacy standards. Most significant to this project, she compared ACRL with ABET standards. Since the librarians felt that the ACRL/STS Information Literacy Standards for Science and Engineering/Technology[14] were a better fit for Engineering 101 and they corresponded better with the ABET standards, the STS standards were integrated into the table. The STS standards correspond numerically with the ACRL standards.

Based on discussions with faculty, the librarians developed the outcomes. Students should understand plagiarism and how to avoid it, know how to evaluate an article, be able to appropriately cite an article, be familiar with four source databases for engineering research and be able to identify the four types of intellectual property. In-class exercises, readings and quizzes were geared toward these outcomes.

Developing the Syllabus

The group began to meet after the grant recipients' orientation session in May. Most meetings happened in July and August. The syllabus from the previous year was undergoing revision so this was an excellent time to include information literacy. The librarians and course coordinator were at all meetings. Various instructors joined in as time permitted. After determining what would be taught in the course each week and how information modules would enhance the teaching, it was agreed that three 50-minute sessions would be placed in weeks two, five, and eleven. While there was much IL content to teach, faculty were very sensitive to the already overloaded content of this course and were reluctant to give up more than three class sessions. Each module was timed within the course sequence to be presented "just-in-time" for the content to be applied in a regularly-scheduled course project. The course management system choice was debated between the campus version and a publisher version. The delay in choice caused a condensed time frame for the loading of materials into a course management system. The campus course management, which is called eCampus, was chosen by the beginning of August. We all received the final syllabus the week before classes began.

Week	Topic
1	Syllabus, Announcements, Intro to Engineering , Ethics in Engineering (Chap. 2)
2	Ethics in Engineering (Chap. 2), Information Literacy I
3	Teamwork (Chap. 3.6)
4	Technical Communication: Technical Report Writing (Chap. 4), Testing of Project 1 (Competition)
5	Technical Communication: Oral Presentations (Chap. 4), Information Literacy II
6	Oral Presentation of Project 1
7	Mid-Semester Exam, Project Management, Microsoft Excel & Data Analysis (Chap. 13-16)
8	Microsoft Excel & Data Analysis (Chap. 13-16)
9	Microsoft Excel & Data Analysis (Chap. 13-16),Technical Communication: Posters (Chap. 4.4)
10	Poster Presentation of Excel Project, Engineering Graphics
11	Engineering Graphics, Information Literacy III
12	Design Project
13	Design Project
14	Design Project, Presentation of Final Project
15	Final Project Technical Report, Course Portfolio
16	Finals Week

Engineering 101 Course Schedule

Content

Since they were allocated three 50 minute sessions, they split the sessions into three distinctive parts: Introduction to Information, Information Tools, and Intellectual Property. Each session included in-class exercises or "Your Turn" exercises in which the students were given an opportunity to participate. Two weeks included readings and an accompanying reading quiz. A test for library information was administered at the beginning and at the end of the semester.

Week	"Your Turn" Exercises	Assessments	Reading
Beginning of Class		Pre Test: Library Information	
Week 2 "Introduction to Information"	Plagiarism scenarios	Plagiarism Avoidance Tutorial	
	When to cite scenarios		
Week 5 "Information Tools"	Identify parts of a citation	PreQuiz: Identify parts of a citation	Beer, D. F. (2009). Accessing Engineering Information. In *A Guide to Writing as an Engineer* (3rd. ed., pp. 165-198). Hoboken, N.J.: Wiley.
	Find a citation	PostQuiz: Identify parts of a citation	
Week 11 "Intellectual Property"	Name that trademark	PreQuiz: Intellectual Property	Rockman, H. (2004). Overview of Intellectual Property Law. In *Intellectual Property Law for Engineers and Scientists*. (pp. 1-8). Hoboken: IEEE Press.
	Find that patent	PostQuiz: Intellectual Property	
End of Class		Post Test: Library Information	

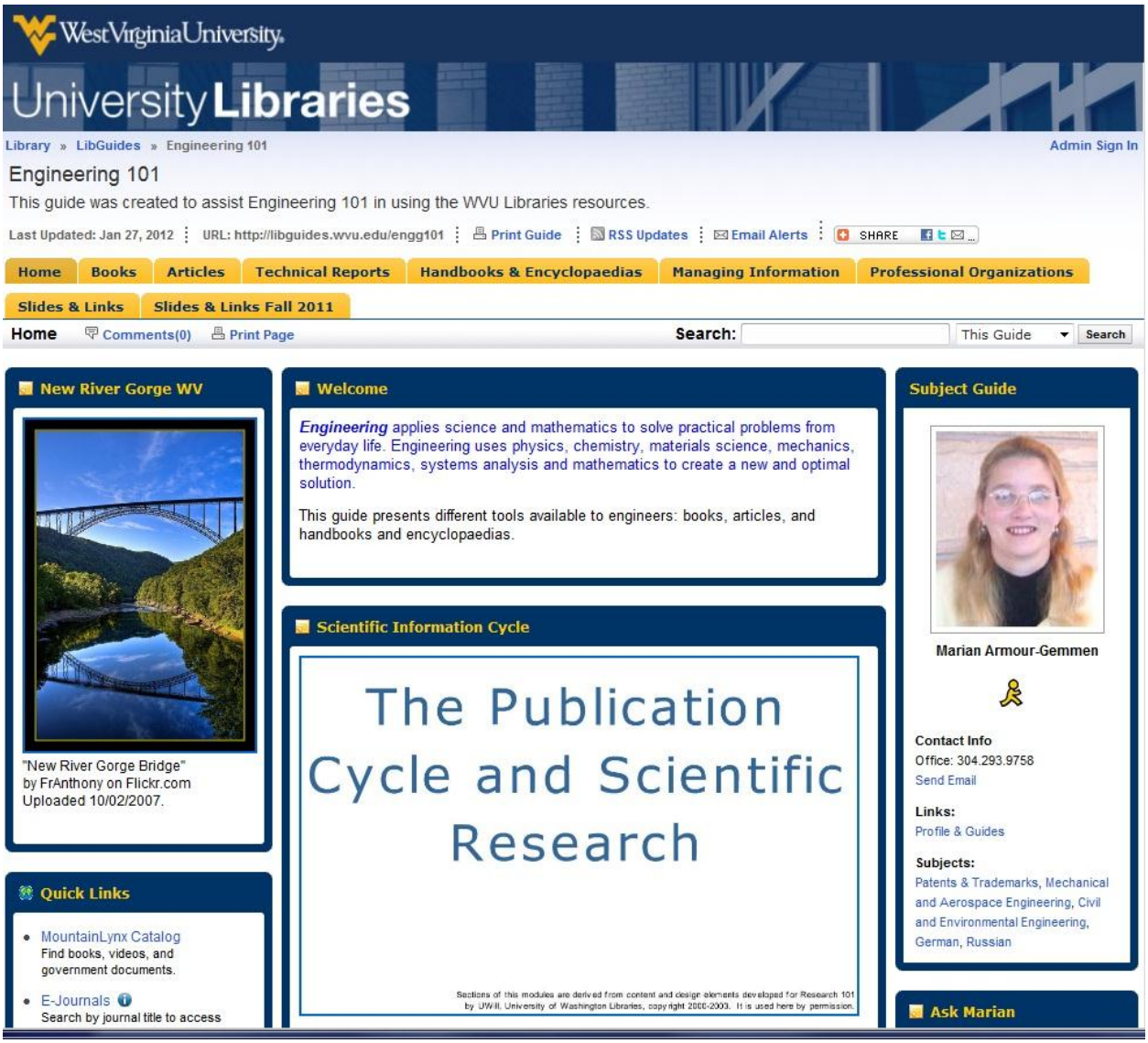
Information Literacy Syllabus

Week two was entitled "Introduction to Information." Since the librarians were coming into the classroom about the same time as the lesson on engineering ethics, this session covered plagiarism, when and how to cite, and how to identify reliable information. They also covered the publication cycle and demonstrated "Summon" a Google-like search tool. Students were directed to complete WVU's plagiarism avoidance tutorial and quiz before the class. Week five was entitled "Information Tools." The class began with introducing types of information, identifying parts of a citation and properly citing an article. After this basic information, tools (databases) to locate books, articles, and technical reports were introduced as well as tools to find a known citation. Week eleven was entitled "Intellectual Property." The four major forms of

intellectual property were covered: Trade Secrets, Copyright, Trademarks, and Patents. Intellectual property was placed in the engineering context: engineers developing it, allowing it to be used, signing of contracts, assigning rights, using non-disclosure agreements. Searching patents was emphasized.

In-class participation ("Your Turn") was an important part of the learning process. Hsieh & Knight[15] and Yeo[16] had particularly insightful articles. Hsieh & Knight found that problem-based learning for engineering students was more effective than lecture based learning. Yeo stressed that freshman engineers should understand plagiarism and Yeo employed the use of scenarios for classroom discussion. During Week two, students were given engineering-related scenarios to decide if plagiarism occurred. There was also a short exercise on when to cite. During week five, students identified parts of and types of citations. Since students were in computer classrooms, they were also directed to find citations online. Citations were chosen from various engineering databases to reflect current engineering topics. During week eleven, students were asked to "Name that Trademark" and search for patents on the USPTO website. Some engineering trademarks were chosen as well as popular trademarks. Patents were selected from the National Inventors Hall of Fame as well as from campus patents and applications.

In order to provide students with additional information, the librarians used the tool LibGuides by Springshare, which WVU librarians use to provide in-depth information to patrons about a topic. The LibGuide for this course [http://libguides.wvu.edu/engg101] included tabs "Home" for introductory information and quick links, "Books" for searching for books, borrowing books and electronic books, "Articles" for subject-specific databases as well as links to finding an eJournal, "Technical Reports" for technical report resources as well as a definition of a technical report, "Handbooks & Encyclopaedias" for a listing of online resources as well as highlighting some of the important discipline-specific handbooks in the stacks, "Managing Information" for tools to manage citations and information about plagiarism and a link to our libraries' plagiarism quiz, "Professional Organizations" for links to important professional organizations, and "Slides & Links" for Power Point presentations from each session as well as links for each session.



LibGuide for Engineering 101. http://libguides.wvu.edu/engg101

Tests and quizzes as well as readings prepared students for class and demonstrated their learning from class. A test for library information was taken at the beginning and end of the semester.(see Appendix A) Questions for this test were partially derived from Swoger[17], Brush[5], Hufford[18] and Hsieh & Knight[15] who have good discussions of assessment and have examples of assessment questions. Additionally, the librarians looked at the topics that were covered and derived questions based on that material. Another important part of the learning process was the pre- and post- quizzes. Week five emphasized identifying parts of a citation and week eleven emphasized basic parts of intellectual property. Two readings were assigned to assist in preparation for weeks five and eleven. The readings were from Beer[19] and Rockman[20] respectively. Quizzes on the readings were developed to emphasize the important parts of the readings. All assessments took advantage of eCampus's capability for randomized questions.

WVU uses Blackboard as its course management system, calling it eCampus. The librarians were given designer privileges. Most of the quizzes and tests were uploaded there so that they could be graded by the system. The "Plagiarism Avoidance Tutorial" resided on the libraries' server, but a link was provided to that tutorial. Modules were created for all three sessions. The links included the important links mentioned in class. Quizzes tested items learned during the sessions.

The week two module included links to the libraries' Plagiarism Avoidance Tutorial, the libraries' homepage, the LibGuide created for this class, MIT's Scientific Publication Cycle[21], as well as the PowerPoint slides from this session. Week five included the pre- and post- quizzes on parts of a citation, the reading quiz, and slides for this session as well as links to the LibGuide created for this class, a "Basic Guide to MLA Documentation", a Citation Builder, a citation locator, and electronic reserves with directions on logging on. Week eleven included the pre- and post- quizzes on intellectual property (see Appendix B), the reading quiz, slides for this session as well as links to the LibGuide created for this class, electronic reserves with directions to log on, United States Patent & Trademark Office, USPTO patent search page, USPTO Classification page, and an additional "folder" which contained links to patent image websites. (For a full listing of links see Appendix C.)

Results

The three content modules, which used the computer-lab classroom and course support technology, were taught by the information literacy experts--the librarians, to more than 700 students in 18 sections of the course. The engineering faculty taught the general technical report writing content. The information literacy content was presented in three 50 minute classes which included in-class activities and incorporated on-line exercises in eCampus.

Data were collected from a variety of assessment sources: pre- and post-tests and quizzes, in-class activities, out-of-class assignments (research papers and technical reports), and feedback from the faculty and students gained through surveys. While much effort was involved in creating pre- and post-assessments for each module as well as a program level pre- and post-assessment, student participation in and completion of these assessments was poor. The team hoped that there would have been a good participation in the tests and quizzes. They would have been able to see how much the students had learned from the different modules. Unfortunately, no section had good participation with as few as five participants and thus they were unable to get enough data for statistically valid comparison. There could be several reasons for the lack of participation, including (1) the course management system was unfamiliar to the students (since they were freshman) and they did not realize that they needed to check it; (2) the professors did not emphasize this aspect of the class; (3) students viewed librarians as guest speakers and not co-instructors for the course so they ignored the librarians' emails and announcements about the quizzes; and (4) the quizzes were not given enough weight in the course grade to entice student participation. These issues will be addressed in the next version of this course.

Attendance was close to 100% at all three class sessions. Participation during the activities in class was also good. Students were engaged with the content and seemed to be able to do the tasks asked of them. Student feedback on the information literacy component of the course was

solicited by the course coordinator and was generally positive. When asked how the information literacy modules helped them, some students responded that they were now able to glean information faster with a focused research strategy; cognizant of the various information sources other than the Internet; and glad to know that they are able to access library resources without physically going to the library.

The most significant measure of the success of this effort was the quality of the student technical reports throughout the class. While the students were not matched to previous year students for comparison, cohorts of entering engineering freshmen at this university have somewhat similar backgrounds and characteristics each year. So, while there was no designated control group to which to compare this pilot group, they can note differences in the first and final technical reports produced by the pilot study cohort of students and the technical reports of recent previous cohorts of first year engineering students. Instructors who taught the course this year and in previous years noted, at least anecdotally, that the overall quality of technical reports was better this year than in previous years. The average scores on the first and final technical reports, this year, were 87% and 92%, respectively. Unfortunately, no aggregate data is available for previous years, since each instructor kept grade records individually. These scores, however, indicate a reasonably high level of mastery of the technical report elements graded.

An added measure of the success of this collaborative effort was evident in the final project "mini-conference" poster sessions in which each project group from all 18 sections presented their work for a one-hour period on a Saturday near the end of the semester. The librarians shared in the grading of student work by serving as evaluators for student projects. Instructors, administrators, librarians, and others who visited the poster sessions were impressed with the quality of the student work, in general, and it was noted that many groups cited sources, appropriately, on their technical posters. Students understood the need to cite their work in all forms of technical writing and applied what they had learned to their poster presentations.

Things to change

It is expected that an improved version of this course will be launched in the fall. While many elements of this collaborative project were successful, there were some significant lessons learned, primarily relating to class time required, librarian-faculty-student communication, student completion of assessments, and student and instructor comfort with using the course management system. In the next iteration of this project, the team will address each of the issues which are described below:

Required Class Time: Some instructors were concerned about losing three classes, even though they agreed that the information literacy components were important. Possible options to reduce the number of class sessions include going in for one in-person class per section, having one or more modules run through eCampus with quizzes and assignments that are automatically graded, and providing one mandatory out of class experience (OCE). The OCE could be done in the engineering building if computer classroom space is available or in the Evansdale Library. Since the library's electronic classroom doesn't accommodate as many students as the engineering classroom, the librarians would need to be available for more sections. In either case, faculty

buy-in regarding the importance of this topic is essential. Faculty need to be present in the classroom while the librarians teach so students see the two as a teaching team.

Communication: Early on professors were included in copies of emails to students. To facilitate inclusion of the professors in class messages, a file of professors' emails was created so that they could be emailed no matter the librarian's location.

Student Participation in Assessments: It is clear that the quizzes and assignments need to be graded and mandatory. Most instructors required them as part of the grade. There was, however, a complication with the grading, so adjustments were made. Initially the library information test was set up as a "poll" in eCampus but this would not allow the instructors to see the results. Later, it was changed to a "quiz" which allowed for grading to appear in the eCampus grading form. More buy-in from professors for the quizzes, by weighting them more significantly in the course grade so students will take them seriously and complete them accordingly is also necessary. In order to encourage students to use eCampus which hosts their assessments, the librarians might visit the classes the week prior to tell them about the assignments and tests that need to be done before each information module.

Course Management System: Loading each module, complete with PowerPoint presentations, pre- and post- quizzes, classroom activities, homework activities, and other resources for student use onto 18 separate sections was tedious and very time consuming. WVU's eCampus required touching each individual section. The librarians will explore ways to simplify the loading of materials to each section.

Above all, this was an amazing opportunity for the librarians to collaborate with faculty to integrate several information literacy components into one course with a large number of students in multiple sections. Although initially daunting, this was an excellent first attempt. Student learning objectives appear to have been met since the assistant dean indicates that the quality of student technical reports was better for this cohort than for previous cohorts. As the lessons learned through this experience are assessed and addressed by this collaborative team, the course can only improve in future implementations.

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Additional Reading

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Appendix A
Pre- and Post- tests

1. The following citation refers to:

Hirtz, Paul. "Solar car racing." *Professional Safety*. 44. 10 (1999): 30-34. Print.

A. A journal article.
B. A book.
C. A chapter in a book.
D. A newspaper article.

2. It is important to cite all work you use in your papers to:

A. To prove that your work has a solid, scholarly basis.
B. To show the research you have done and allow others to locate the material themselves.
C. To give credit to the author and avoid plagiarism.
D. All of the above.

3. The following citation refers to:

Hoffman, Peter. *Tomorrow's energy: hydrogen, fuel cells, and the prospects for a cleaner planet*. Cambridge, MA: MIT Press, 2001. Print.

A. A journal article.
B. A book.
C. A chapter in a book.
D. Newspaper article.

4. Copying and pasting from the Internet can be done without citing the Internet page, because everything on the Internet is common knowledge and can be used without citation.

True or False

5. Of the following types of information, which one does NOT need to be acknowledged?

A. A word-for-word quotation from *The New York Times* online about economic recovery.

B. A photograph of Rosa Parks that you found in *Women in World History: A Biographical Dictionary*.

C. A paragraph you wrote summarizing information from a *Newsweek* article about bioengineered food.

D. A list of three most important things you think students can do to succeed in college.

6. You are in a class where the professor requires that your research be strictly based on scholarly resources. Which of the following search engines/databases would be appropriate for you to use?

A. Google.

B. Wikipedia.

C. Yahoo.

D. All of the above.

E. None of the above.

7. What must you search to locate books or eBooks in the library?

A. Amazon.com.

B. MountainLynx, library catalog.

C. Engineering Village.

D. Google.com.

8. Which of the following material takes the shortest time to publish?

A. Book (print or online).

B. Journal (print or online).

C. Internet news.

D. A magazine article.

9. Which of the following are advantages of scholarly articles available by library subscription over free resources available over the Internet?

A. They have passed a peer review by one or more professionals with academic credentials in that scholarly discipline.

B. They have been indexed by professional catalogers to allow retrieval of all relevant articles on a given topic.

C. They cite other scholarly work upon which their research is based, allowing readers to verify methodology and trace related research.

D. All of the above.

10. A Patent is:

A. A form of protection provided to authors of 'original works of authorship' including literary…and certain other intellectual works, both published and unpublished.
B. A word, name, symbol, or device that is used in trade with goods to indicate the source of goods and to distinguish them from the goods of others.
C. a device or technique used in a particular trade or (transf.) occupation and giving an advantage because not generally known.
D. a property right granted to an inventor to exclude others from making, using, offering for sale, or selling the invention.

11. When evaluating a resource which is NOT a reason for selecting the resources for an engineering class?

A. Author affiliation.
B. Recent copyright date.
C. Cover article in *Newsweek*.
D. Includes a bibliography.

12. Which is of the following is a scholarly journal

A. *Engineering News Record.*

B. *Newsweek.*

C. *Thin Solid Films.*

D. *Chemical marketing reporter*.

13. What is the best way to find an article on a given subject?

A. Page through print volumes of academic journals.

B. Search the Web search engine Google or Yahoo.

C. Search an online database like IEEE or Academic Search Premier.

D. Search the online library catalog.

14. How would you find the engineering databases for peer-reviewed research?

A. Use Summon.

B. Use MountainLynx the online catalog.

C. Select “Engineering” Subject listing on Database page.

D. Type "Engineering" in the search E-Journal box.

15. What is the most effective prior art patent search?

A. Keyword Searching.

B. Classification Searching.

C. Google.

D. Subject Searching.

Appendix B
Sample Quiz for Week 11 (Intellectual Property)
Note: other questions were rotated through, but each question covered a topic, e.g. question one's answer was trade secret or other corresponding questions would be other trade secrets.

1. Coca Cola's recipe is an example of a
    a. Trade secret
    b. Patent
    c. Copyright
    d. Trademark

2. When you go to work at a firm an employer may have you sign a "Non-Disclosure Agreement" for product. This agreement means
    a. You can tell anyone about how to make this product.
    b. You may tell anyone as long as you whisper.
    c. You will not disclose how to produce this product.
    d. You will not sell this product to anyone.

3. "Built Ford Tough" is an example of a
    a. Trademark
    b. Copyright
    c. Patent
    d. Trade secret

4. *Steve Jobs* by Walter Isaacson is an example of
    a. Copyrighted book.
    b. Patented book.
    c. Trademarked book.
    d. Book filled with trade secrets.

5. A property right covering an invention is called
    a. Trademark
    b. Copyright
    c. Patent
    d. Trade secret

Appendix C
Links for Fall 2011

Website	URL
Engineering 101 LibGuide	http://libguides.wvu.edu/engg101
WVU Libraries	http://www.libraries.wvu.edu/
eReserves	http://ereserves.lib.wvu.edu/
Plagiarism Avoidance Tutorial	http://www.libraries.wvu.edu/instruction/plagiarism/
Information Cycle (MIT)	http://ocw.mit.edu/ans7870/3/3.093/f06/tutorials/pub-cycle-with-quiz.swf
Basic Guide TO MLA Documentation	http://www.libraries.wvu.edu/instruction/guides/mla.pdf
Citation Builder	http://www.libraries.wvu.edu/instruction/citationbuilder/index.php
Have a citation? Find it @ WVU	http://ad4tq3gq5x.search.serialssolutions.com/?SS_Page=refiner&SS_RefinerEditable=yes
United States Patent & Trademark Office	http://www.uspto.gov
USPTO patent search page	http://patft.uspto.gov/
USPTO Classification page	http://www.uspto.gov/web/patents/classification/
Pat2Pdf (Patent Image Website)	http://www.pat2pdf.org
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