Information Literacy in Engineering Technology Education: A Case Study

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Abstract

Information literacy is a vital component of engineering and engineering technology programs, as evidenced by its alignment with the engineering design process and as required by ABET, the body that accredits all engineering and many engineering technology undergraduate programs. However, information literacy in engineering technology and applied engineering curricula is understudied when compared with information literacy in engineering programs. This paper describes a case study of information literacy integration into an undergraduate mechanical engineering technology design course, with a focus on patent information and patent searching. Online pre- and post-assessment data for four semesters were analyzed, showing improvements in student self-reported confidence and content knowledge of patents searching, post intervention. This approach shows promise in improving student outcomes, as well as providing an opportunity for collaboration between librarians and engineering technology faculty. Suggestions for refining further iterations of this project are included.

1. Introduction

Information literacy (IL) includes the abilities to locate, understand, evaluate, manage, and use scholarly literature and other types of information sources (e.g., patents, technical standards, books, ebooks, websites) effectively and ethically. These interdependent abilities are the essence of lifelong learning and vital for future applied engineers and technologists. In an engineering technology context, this might take the form of finding existing technical specifications and physical property data, determining the relevance and validity of the information, using the information to inform their own design, and presenting the new design to stakeholders. An information literate engineering technology student should be able to find, analyze, synthesize, and present information on a given technical (or non-technical) topic. In this context, information literacy plays a role in the engineering design process, the system used by engineers and engineering technologists to solve technical problems. The models for information literacy closely parallel those of engineering design (Fosmire 2012). Design thinking can be seen as a critical part of any engineering technology curriculum, as evidenced in ABET's accreditation criteria (2017a).

The ABET Engineering Technology Accreditation Commission (ETAC) criteria for accrediting engineering technology baccalaureate degree programs, student outcomes "f" ("an ability to identify and use appropriate technical literature") and "g" ("an understanding of the need for and an ability to engage in self-directed continuing professional development") are evidence of the importance of information literacy to engineering technology undergraduate education (2017a). The corresponding Engineering Accreditation Commission (EAC) has similar standards, and information literacy concepts can be mapped to its section on student outcomes, including those related to lifelong learning, ethical behavior, and the ability to think critically (Riley et al. 2009). ABET distinguishes between engineering technology and engineering through the former's focus on application and implementation versus the latter's focus on higher order conceptual design (2017b), and while no studies have been done on the information literacy content of ETAC's accreditation criteria, the same information literacy parallels exist. Other engineering education-focused organizations, such as KEEN (Kern Entrepreneurial Engineering Network), also believe that integrating information literacy education into curricula is important to prepare students for their future careers (2018).

The choice of specific information sources to be discussed when incorporating information literacy into a science or technology course will necessarily vary widely. One possibility, especially in curricula with a focus on application and design, is the forms of intellectual property relevant to innovation and entrepreneurship: patents and trademarks. They can provide an opportunity to discuss information-related topics as wide ranging as how legal and technical language intersect in the form of patent claims (Myers 1995), the ethical usage of others' intellectual property (Whitbeck 2011), and the importance of source identifiers in entrepreneurship activities (Jewell 2009). As forms of information prevalent in industrial and entrepreneurial settings, they allow for the discussion of information literacy concepts with real-world context. In an educational setting, patents in particular can be used to inspire and inform creative problem solving (Phillips and Zwicky 2017), act as case studies for examining successful and unsuccessful attempts at innovation (Whittemore 1981), and provide a window into research being done in the private sector that is not published in traditional scholarly sources (Trippe 2014).

Information literacy education is often integrated into engineering undergraduate curricula through collaborations between librarians, also known as information specialists, and discipline faculty members. These interactions are well studied, with papers covering a variety of instructional approaches (Hanlan, Ziino, and Hoffman 2014; Hsieh and Knight 2008; Leachman and Leachman 2015; Phillips et al. 2015; Plouff and Morrow 2011; Zhang, Goodman, and Xie 2015). One way to indirectly assess the extent to which this topic is covered in the literature is to search prominent research databases, for example *Compendex* (the most comprehensive engineering-focused database) and *Library, Information Science and Technology Abstracts* (LITA, a large library science-focused database). Searches in *Compendex* and LITA for the concepts of "engineering," "information literacy," and "undergraduates," over the past 10 years, yield 41 and 12 results, respectively. However, while IL engineering curricula integrations may be well documented, evidence of IL integrations into applied engineering or engineering technology curricula is relatively understudied. Performing similar searches in *Compendex* and LITA for the concepts of "engineering technology" or "applied engineering," "information literacy," and "undergraduates" over past 10 years yields four and two papers, respectively.

While there are some studies focused on integrating IL into applied engineering (or engineering technology) undergraduate education (Erdmann and Harding 2010; Phillips and McPherson 2016; Sapp Nelson et al. 2007), they are less common. Outside of the traditional academia, there have been studies of IL in engineering technology in community (Hill, Best, and Dalessio 2012) and technical college (Sandercock 2016) settings. The reasons for this disparity are unclear, although they may be attributable to the low ratio of engineering technology undergraduate programs to engineering undergraduate programs or possibly the engineering technology programs' focus on more practical and applied scholarship.

This case study, as a report of IL instruction and assessment in a design course in the mechanical engineering technology (MET) undergraduate program at Purdue University helps fill this gap. IL education was integrated through an active learning session developed collaboratively between two librarians and the course instructor. Student learning was assessed through pre- and post-information literacy session tests. The research focused on this question: Does IL instruction result in increased undergraduate engineering technology student IL learning and self-efficacy?

2. Course Background

Students majoring in Mechanical Engineering Technology at Purdue must take at least two upper level elective courses within their curriculum. One of their options is MET 302, CAD in the Enterprise (CAD being "computer-aided design"), a three-credit course offered during the spring and summer terms. With an enrollment of approximately 24 students per semester, this course is typically taken by juniors and seniors. As such, this course serves as an excellent opportunity for students on the verge of graduation to investigate the design process for new machines and to develop a better overall understanding of mechanical design.

Historically this course was taught with a strict focus on CAD tools and techniques. As a part of the ongoing transformation of the Purdue Polytechnic Institute curricula to incorporate more project-based learning, this course has seen a drastic change in both its structure and content. Rather than just focusing on a rudimentary introduction to various CAD software packages, the redesigned course revolves around a full mechanical design project. In Spring 2015, students were given mechanical design prompts (and assigned relevant CAD packages) and guided through the design process with the aim of creating innovative solutions to these problems. However, upon completion of the term and reflection of this project, the instructor determined that many students lacked knowledge and understanding of the research process as it pertained to design; they had been unable to research pre-existing designs and solutions to their particular problem, and their designs had reflected this lack of context.

With this in mind, the instructor collaborated with two libraries faculty members in Spring 2016 to create lessons and activities focused on design research and fostering innovative ideas. The instructional team determined that the students had previously received fundamental IL training related to scholarly research in a first-year course, so they chose to focus on searching for and using patent information to inform design decisions. As previously discussed, patents were an ideal choice for the IL component of this course, with their demonstrated capacity to inspire creative problem solving in the engineering design context (Phillips and Zwicky 2017) and as the practical, case-study nature of patents make them appealing to engineering technology students.

2.1 Information Literacy Instruction in MET 302

The instructional team designed and facilitated a 75-minute, in-class, active learning lesson that consisted of debriefing a pre-class assignment focused on examining the parts of a patent (Appendix A), a short (10-15 minutes) PowerPoint introduction to patents and patent searching, and a group patents searching activity (Appendix B). The lesson plan for the in-class session in included as Appendix C. Neither the pre-class assignments nor the group searching activity worksheets were collected or graded during this pilot period. However, the course instructor plans to make both of these assignments graded components of the course in future terms. The student learning outcomes for this lesson were

- Demonstrate a basic understanding of patents (purpose, creation, content) in order to know when the source type is appropriate to fulfill an information need.
- Describe the different values of patent literature in order to understand the different motivations for patent searching.
- Use a combination of different search techniques (e.g., keywords, classifications, references) to begin an iterative patent search.
- Perform iterative patent searches in order to locate an appropriate set of patents related to the project topic.

3. Methods

3.1 Participants

The study participants consisted of undergraduate students (n=84; 81 male, 3 female) enrolled in the elective course MET 302 during the Spring 2016, Summer 2016, Spring 2017, and Spring 2018 terms. All of the participants were upper-level students and MET majors. The university's Institutional Review Board reviewed and approved this study (IRB #1604017610) as exempt research.

3.2 Data Collection

Data were collected through an online pre-assessment the students were asked to complete before the IL class and an online post-assessment the students completed in class, at the end of the IL session. Both assessments are attached as Appendix D. Google Forms was the online platform used to conduct the assessments. Because the assessments were anonymous, some of the 84 students did not participate in either the pre- (n=72) or the post-test (n=79). Additionally, students were not required to complete all of the questions to submit the online forms.

3.3 Data Analysis

The pre- and post-assessment results for each term were exported from Google Forms, combined, and analyzed using Microsoft Excel to compute the statistics presented in the results and discussion section.

4. Results & Discussion

4.1 Students Pre-Instruction Patent Searching Experience

Table 1 presents the results of student responses (n=72) to the multiple-choice pre-assessment question: What is your experience with patent searching? Check all that apply. The majority of students (56.3%) reported no prior experience with patent searching. Some students had searched for patents prior to the instruction session for class assignments (36.6%) or personal needs/interests (5.6%), or for both class assignments and personal needs/interests (1.4%).

4.2 Self-Reported Patent Searching Ability

Table 2 presents the results of pre- and post-instruction student self-assessment related to confidence in their ability to conduct a thorough patent search. Pre and post self-confidence was evaluated by student responses to this question: Rate your level of agreement with this statement: "I am confident in my ability to conduct a thorough pat-

Table 1. Relative frequency of student pre-instruction patent searching experience.

Statement	Relative Frequency (n=72)
"I have no experience searching patents."	56.3%
"I have searched for patents before for class assignments."	36.6%
"I have searched for patents before for personal needs/interests."	5.6%
"I have searched for patents before, both for class assignments and personal needs/interests."	1.4%

Table 2. Statistical breakdown of overall self-reported confidence data ($p < 0.01$).

	Pre-Instruction	Post-Instruction
Mean	2.38	3.95
Variance	1.05	0.38
Standard deviation	1.03	0.62
N	72	79
Cohen's *d*	1.87	
p value (t-test, 2-tailed)	< 0.01	

Table 3. Student responses to true/false questions regarding patents.

Proposition	Answer	Correct (Pre, n=72)	Correct (Post, n=79)
A patent grants intellectual property rights to an inventor or assignee.	TRUE	97%	97%
Patents are issued by governments.	TRUE	68%	95%
Patents contain detailed technical information.	TRUE	82%	96%
Using topic keywords and synonyms is the most efficient way to search for relevant patents. / Keyword searching alone is the most efficient way to search for relevant patents.	FALSE	17%	77%
The purpose of patents is for academics to formally present their research, including their methodologies and findings.	FALSE	58%	48%
Only corporations or universities can apply for patents.	FALSE	100%	97%

ent search." A standard five-point Likert scale was used, with "1" being "not confident" and "5" being "very confident."

An analysis of pre and post tests using an unpaired, two tailed t-test of means shows that overall students reported a higher level of self confidence in their abilities to conduct patent searches after the active learning IL instruction session (mean = 3.95), than before (mean = 2.38). This difference is significant at the one percent level ($p < .01$), meaning there is less than a 1% chance the increase in student self-confidence reporting occurred at random. Similarly, the calculation of Cohen's d shows an effect above 1.2 ($d = 1.87$), indicating the two means differ by more than 1.2 standard deviations. Per Sawilowsky (2009), this means the effect can be described as "very large" (a d of 2.0 would be "huge").

4.3 Content Knowledge

Table 3 presents the students' pre- and post-instruction responses to a series of six statements related to patent information, which the students evaluated as true or false. The same statements, or functionally equivalent statements, were used in both cases. The students' success in evaluating these statements, even after instruction, was mixed. Responses to three statements showed improvement in terms of correct responses, pre- to post-; two statements remained essentially stable; and one statement showed a decrease in correct responses. The statements about who issues patents and whether or not patents contain technical information showed increases in correct responses (27% and 14%, respectively). The statement about search strategies, a primary focus of the instruction session, showed a large increase in correct responses (60%). The statements regarding the definition of a patent and who is allowed to file for a patent remained approximately stable at 97-100% correct. The statement about the purpose of a patent showed fewer correct answers (10%) over the course of the instruction.

In the case of the patent purpose question, the decrease might be attributable to the session's approach to patent information. Rather than focus on patents in their context as commercial documents, the session focused on the ability of patents to provide an insight into research happening in the academic and corporate worlds. This may have given some students the mistaken impression that reporting research is a patent's primary purpose.

It is evident by examining four semesters of student self-reported data, the students believe they learned skills in the instruction session that enable them to be more effective patent searchers. The authors recognize there are limitations to self-reported data as compared to actual student abilities. For example, Douglas, Wertz, Fosmire, Purzer, and Van Epps (2014) found that engineering students self-reported information literacy skills tend to overstate their abilities. However, since, in this case study self-reported confidence was measured before and after the instructional intervention and significant differences were found, the authors believe this is a promising approach to integrating IL instruction into an engineering technology course.

Future work could involve modifying the assessment of the IL session to further directly measure student skills before and after the intervention, rather than relying heavily on self-reports, or "measures of attitude" (Schilling and Applegate 2012). One small change that could be implemented in the pre-assignment is to require students to locate patents on their topic and report their findings before the IL intervention. The pre-assignment results could then be compared with the patent searching results students submit as part of the in-class exercise and later in the course, as part of team presentations and in written reports on their design projects. Additionally, the pre-assignment could be expanded to incorporate content related to the other learning outcomes of the lesson where students showed few or no gains from the pre- to post-assessment, such as the purpose of patent literature. Lastly, making the pre- and post-assessments a required part of the course would allow the researchers to track the progress of individual students as they work through the material.

5. Conclusion

This case study explores integrating information literacy into an undergraduate engineering technology design course through a lesson focused on patents and patents searching, developed collaboratively between the course instructor and engineering librarians. Prior to this course, the majority of the students (56%) reported no prior experience with patent searching. The authors analyzed pre/post self-reports and found student self-efficacy with patent searching increased significantly ($p<0.01$) after the instructional intervention. Additionally, pre/post-content knowledge tests indicate IL instruction leads to increased undergraduate student IL learning, most notably for the primary focus of the authors' lesson, patents searching (60% increase).

This work helps fill a gap in the literature of reporting on IL integration in engineering technology curricula, as several previous studies have explored engineering IL integration, but few have focused on engineering technology programs specifically. It also provides a practical example of an IL lesson that can be implemented or modified to fit the needs of nearly any engineering technology program and aligns with the ABET-ETAC accreditation criteria pertaining to knowledge of relevant technical literature and self-directed professional development. This study serves as a starting point for future researchers to investigate more extensive information literacy integrations into engineering technology curricula, which could focus on other aspects of intellectual property, such as patent claims, copyright, and trademarks.

References

ABET. 2017a. "Criteria for Accrediting Engineering Technology Programs." http://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-technology-programs-2018-2019/.

———. 2017b. "Engineering vs. Engineering Technology."http://www.abet.org/accreditation/new-to-accreditation/engineering-vs-engineering-technology/.

Douglas, Kerrie Anna, Ruth E H Wertz, Michael Fosmire, Senay Purzer, and Amy S Van Epps. 2014. "First Year and Junior Engineering Students ' Self-Assessment of Information Literacy Skills First Year and Junior Engineering Students ' Self -Assessment of Information Literacy Skills Abstract." In *2014 ASEE Annual Conference and Exposition*, 24.607.1-24.607.10. Washington, DC: ASEE.

Erdmann, Charlotte, and Bruce Harding. 2010. "Leveraging the Internet and Limited on-Campus Resources to Teach Information Literacy Skills to Future Engineering Practitioners." In *2010 ASEE Annual Conference and Expositio*n, 15.841.1-15.841.15. Washington, DC: ASEE.

Fosmire, Michael. 2012. "Information Literacy and Engineering Design: Developing an Integrated

Conceptual Model." *IFLA Journal* 38: 47-52. doi:https://doi.org/10.1177/0340035211435071.
Hanlan, Laura Robinson, Rebecca A Ziino, and Allen H Hoffman. 2014. "Student Attitudes and Measures of Success in Information Seeking in an Introductory Mechanical Engineering Design Course." In *2014 IEEE Frontiers in Education Conference Proceedings*. Piscatawny, NJ: IEEE. doi:10.1109/FIE.2014.7044201.
Hill, Katherine Hoover, Matthew M Best, and Anthony P Dalessio. 2012. "Information Literacy in the Engineering Technologies at the Community College: A Literature Review." *Community & Junior College Libraries* 18 (3-4): 151-67. doi:https://doi.org/10.1080/02763915.2012.812920.
Hsieh, Cynthia, and Lorrie Knight. 2008. "Problem-Based Learning for Engineering Students: An Evidence-Based Comparative Study." *The Journal of Academic Librarianship* 34 (1): 25-30. doi:https://doi.org/10.1016/j.acalib.2007.11.007.
Jewell, Cathy. 2009. "Trademarks: Valuable Assets in a Changing World." *WIPO Magazine*. http://www.wipo.int/wipo_magazine/en/2009/04/article_0002.html.
KEEN. 2018. "KEEN - Mindset Matters." https://engineeringunleashed.com/mindset-matters.aspx.
Leachman, Chelsea, and Jacob William Leachman. 2015. "If the Engineering Literature Fits, Use It! Student Application of Grey Literature and Engineering Standards." In *2015 ASEE Annual Conference and Exposition*, 26.881.1-26.881.10. Washington, DC: ASEE.
Myers, Greg. 1995. "From Discovery to Invention: The Writing and Rewriting of Two Patents." *Social Studies of Science* 25 (1): 57-105. doi:10.1177/030631295025001004.
Phillips, Margaret, Sarah Lucchesi, Jennifer Sams, and Paul Van Susante. 2015. "Using Direct Information Literacy Assessment to Improve Mechanical Engineering Student Learning: A Report on Rubric Analysis of Student Research Assignments." In *2015 ASEE Annual Conference and Exposition*, 26.1663.1-26.1663.26. Washington, DC: ASEE.
Phillips, Margaret, and Paul McPherson. 2016. "Using Everyday Objects to Engage Students in Standards Education." In *2016 IEEE Frontiers in Education Conference Proceedings*. Piscataway, NJ: IEEE. doi:10.1109/FIE.2016.7757698.
Phillips, Margaret, and Dave Zwicky. 2017. "Patent Information Use in Engineering Technology Design: An Analysis of Student Work." *Issues in Science and Technology Librarianship* 87. doi:10.5062/F4ZS2TR8.
Plouff, Chris, and Deborah Morrow. 2011. "Embedding Lifelong Learning Skills into a First-Year Engineering Course through Introduction of an Independent Research Project and Information Literacy Skills." In *2011 ASEE Annual Conference and Exposition*, 22.555.1-22.555.25. Washington, DC: ASEE.
Riley, Donna, Rocco Piccinino, Mary Moriarty, and Linda Jones. 2009. "Assessing Information Literacy in Engineering: Integrating a College-Wide Program with ABET-Driven Assessment." In *2009 ASEE Annual Conference and Exposition*, 14.240.1-14.240.8. Washington, DC: ASEE.
Sandercock, Patricia. 2016. "Instructor Perceptions of Student Information Literacy: Comparing International IL Models to Reality." *Journal of Information Literacy* 10 (1): 3-29. doi:10.11645/10.1.2065.
Sapp Nelson, Megan, Michael Fosmire, Amy Van Epps, and Bruce Harding. 2007. "Next Generation of Tutorials: Finding Technical Information." In *2007 ASEE Annual Conference and Exposition*, 12.1106.1-12.1106.12. Washington, DC: ASEE.
Sawilowsky, Shlomo S. 2009. "New Effect Size Rules of Thumb." *Journal of Modern Applied Statistical Methods* 8 (2): 597-99. doi:10.22237/jmasm/1257035100.
Schilling, Katherine, and Rachel Applegate. 2012. "Best Methods for Evaluating Educational Impact: A Comparison of the Efficacy of Commonly Used Measures of Library Instruction." *Journal of the Medical Library Association* 100 (4): 258-69. doi:10.3163/1536-5050.100.4.007.
Trippe, Anthony. 2014. "Revisiting an Old Standard - 80% of Technical Information Is Found Only in Patents." *Patinformatics*. April 21. http://www.patinformatics.com/revisiting-an-old-standard-80-of-technical-information-is-found-only-in-patents/.
Whitbeck, Caroline. 2011. *Ethics in Engineering Practice and Research*. New York: Cambridge University Press.
Whittemore, O. J. 1981. "Patents: A Tool for Teaching Design." *Engineering Education* 71: 299-301.
Zhang, Qinqin, Maren Goodman, and Shiyi Xie. 2015. "Integrating Library Instruction into the Course Management System for a First-Year Engineering Class: An Evidence-Based Study Measuring the Effectiveness of Blended Learning on Students' Information Literacy Levels." *College & Research Libraries* 76 (7): 934-58.

Appendix A

Pre-work for Patents Searching Session

This pre-work will take about 20-25 minutes of your time.

1. **Complete this pre-assessment survey by class on [Due Date]:[Link to that term's pre-assessment]**
2. **Complete this introductory patents activity by class on [Due Date]. Here you will examine two U.S. patents and answer questions about them.**

View US Patent #8876571 (PDF: http://bit.ly/1WKIzQ8)

Field #54 is the title of the patent.

a. What is this patent's title? ______________________________

b. Looking at the title, the abstract, and the drawings, how would you describe this invention in your own words?

____

2. Field #45 is the issue date and Field #22 is the filing date.
   a. When was this patent granted? __________
   b. Assuming all fees are paid, patents last approximately 20 years from their filing date. What year will this patent expire? __________
   c. Approximately how long did it take for the United States Patent & Trademark Office to approve this patent? __________
3. Field #72 lists the inventors and Field #73 lists the assignee (the person or company to whom the inventors assigned the rights).
   a. Who are this patent's inventors? ______________________________
   b. Who is this patent's assignee? ______________________________
4. Field #52 lists the codes used by the United States government to identify the types of technology used in the patent. The main classification currently used by the government is the CPC system.
   a. What are the primary CPC classifications (written in bold)? ______________________________
   b. Use http://worldwide.espacenet.com/classification to get the names for the two listed primary classifications. ______________________________
5. The claims, the precise legal definition of the patent, appear as a numbered list at the end of the document, following the words "we claim."
   a. How many claims are listed?__________
   b. How many independent claims (claims that do not refer back to a previous claim) are listed? __________

View US Patent #8662513 (PDF: http://bit.ly/1Vlhba6)

6. Field #54 is the title of the patent.
   a. What is this patent's title? ______________________________
7. Field #52 lists the codes used by the United States government to identify the types of technology used in the patent. This patent uses an older system, USPC, which is no longer in use.
   a. What is the primary USPC classification (written in bold)? ______________________________
   b. Use http://www.uspto.gov/web/patents/classification/ to convert the USPC classification to a CPC classification. Select "USPC" as the system, and select "Statistical Mapping from USPC to CPC." What is the most likely CPC classification? ______________________________
   c. Use http://worldwide.espacenet.com/classification to get the name for the most likely CPC classification. ______________________________
8. Many inventors apply for patents in multiple jurisdictions. Go to http://www.lens.org and search for "US8662513," then select the patent, and go to the "Family Info" tab.
   a. Looking at the world map on this page, in which other countries is this inventor pursuing a patent? ______________________________
   b. Looking at the list of documents below the map, how many patents have actually been granted (i.e. how many are listed as "granted patents" instead of "patent applications")? ______________________________

Appendix B

In-Class Patent Searching Activity

Work in your teams to complete this activity for your projects.

1. **Spend 5 minutes describing your invention - get ideas from all team members.**
    a. How would you describe the invention?
    b. How would you describe it if you were explaining it to a small child?
    c. How would you describe it if you were explaining it to an expert in the field?
    d. List synonyms and alternate descriptions for the invention.
    e. What is the main use case for the invention? Are there alternate use cases to consider?
2. **Do a preliminary keyword search using http://www.lens.org or http://www.google.com/patents.**
    a. Use some of the keywords you brainstormed in #1 to do a quick keyword search of the full text. How many results did you get?
    b. Narrow the search results to only United States of America patents using the "Jurisdiction" option under "Refine Search" in Lens or the "Patent Office" option under "Search Tools" in Google. How many results did you get?
    c. Narrow the search results to only Granted Patents using the "Document Type" option under "Refine Search" in Lens or the "Filing Status" option under "Search Tools" in Google. How many results did you get?
    d. Look at the top hits, ranked by relevance. Find one that's in the right area of technology as your invention. Not the same, obviously, but in the right ballpark. You may need to click through to the full patent, since patent titles can be inscrutable. What is it?
    e. In the patent record, at the bottom of the page, there should be a list of "CPC Classification" or "Cooperative Classification" codes. What are they?
3. **Identify relevant classifications using http://worldwide.espacenet.com/classification or http://www.uspto.gov/web/patents/classification/cpc.html**
    a. Take the main CPC classification (the first one) and identify what each of the pieces mean. As an example, here is the classification for a card shuffling device:

        A: Human necessities

        A63: Sports and games

        A63F: Card, board, roulette, miniature, and video games

        A63F1: Card games

        A63F1/12: Card shufflers

    b. Discuss as a team - does this classification make sense for your invention?
    c. Are there any classifications nearby that might better describe your invention? If so, what are they?
4. **Use Lens (http://www.lens.org) to perform a classification search.**
    a. Take your new classification from #3c (or the original one from #3a if it still works) and search using the Advanced Search feature. Select "CPC Classifications" in the dropdown menu. How many results did you get?
    b. Refine to U.S.A. granted patents, the same way as in #2. How many results did you get?
    c. Go to the graphic view (the little bar graph icon in the upper right of the search results) and answer the following questions.
        i. Who are the two most prolific inventors in this class?
        ii. Which two companies (or people) own the most patents in this class?
        iii. Aside from the class we just searched, what are the two most common CPC classifications in this class?

(continued on page 56)

Appendix B (continued from page 55)

5. Look at the results.

a. Go back to the list of search results and look at the documents you've retrieved. Are they in the right ballpark? How do the results compare to the results (numbers of results received, relevancy of results, etc.) from the basic keyword search in #2?

b. Pick a relevant patent and take a look at it (the PDF, not the Lens record).

i. Who is the inventor?

ii. Who is the assignee?

iii. When was it filed, and was it before or after February 9, 1996?

iv. What are the other CPC classifications listed?

v. Are there any references listed? How many?

vi. Looking at the claims, how close is this to your invention?

vii. Do you see any keywords or ways of describing the invention that you wouldn't have expected, based on your brainstorming (#1)?

6. Iterate.

a. Perform the following searches and compare the results to previous searches:

i. Search using one of the alternate CPC classes you've identified (#3c, #4c, #5b).

ii. Search for one of the references (#5b) using the patent number.

iii. Search for one of the alternate keywords (#5b).

iv. Search for other patents by the most prolific inventor in this field (#5b).

Appendix C
In-class Patents IL Lesson Plan

Student pre-work (assigned by instructor a few days before class)	See Appendix A
15 min	Introduction • Ask the students to complete the online pre-assessment as they come into class, if they have not already • Debrief pre-work — go through by bringing up the worksheet and patents. Walk through — pausing at some points to address questions like: o how did you describe the first patent in your own words? o what you did put for 2b -- the year the patent expires? o what did you put for 8A, 8B? • Explain the rest of the session to the students: Now that they have some experience with patents, we will spend about 10-15 minutes providing a short introduction to patents and patent searching and then the remainder of the class time will be spent working in their groups to find patents related to their design projects.
15 min	PP slides on IL session goals and patent basics
25 min	Group work - See Appendix B
20 min	Activity debriefing discussion, conduct post-assessment, discuss comparison to pre-assessment results, wrap up

Appendix D: Online Pre and Post Assessments

Pre-Assessment

1. What is your experience with patent searching? Check all that apply:
   - I have searched for patents before for class assignments
   - I have searched for patents before for personal needs/interests.
   - I have no experience searching patents.
   - Other: (write in option)
2. Rate your level of agreement with this statement: "I am confident in my ability to conduct a thorough patent search." (Likert Scale)

1 - Not Confident	2	3	4	5 - Very Confident

3. Evaluate the following statements about patents. Check all that are TRUE:
   - The purpose of patents is for academics to formally present their research, including their methodologies and findings.
   - A patent grants intellectual property rights to an inventor or assignee.
   - Patents are issued by governments.
   - Only corporations or universities can apply for patents.
   - Patents contain detailed technical information.
   - Using topic keywords and synonyms is the most efficient way to search for relevant patents.

Post-Assessment

1. Rate your level of agreement with this statement: "I am confident in my ability to conduct a thorough patent search." (Likert Scale)
2. Evaluate the following statements about patents. Check all that are TRUE:

1 - Not Confident	2	3	4	5 - Very Confident

   - The purpose of patents is for academics to formally present their research, including their methodologies and findings.
   - A patent grants intellectual property rights to an inventor or assignee.
   - Patents are issued by governments.
   - Only corporations or universities can apply for patents.
   - Patents contain detailed technical information.
   - Using topic keywords and synonyms is the most efficient way to search for relevant patents. (spring 2016 version) / Keyword searching alone is the most efficient way to search for relevant patents. (summer 2016 and spring 2017 versions)

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Margaret Phillips is an assistant professor of library science and engineering information specialist in the Purdue University Libraries. As libraries faculty, Margaret specializes in access to technical information resources; instructs students on how to identify, locate, critique, and retrieve information; and collaborates with faculty colleagues in the College of Engineering and Purdue Polytechnic Institute to teach specialized data and information courses and/or participate as a member of faculty teaching teams. Her research interests include information literacy in engineering and technology curricula, technical standards, and information-seeking behavior of engineering and technology students and professionals.

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