

Integrating information literacy into a first year mass and energy balances course

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Introduction

- Curriculum-integrated instruction
 - Effective for student learning
 - Requires buy-in and collaboration from faculty
 - Requires detailed attention to integration in course
- Political and logistical challenges
 - Packed nature of engineering curriculum
 - Resistance to change
 - Organizational issues within institutions

Background

- At Smith: College-wide curriculum-integrated approach to information literacy
- Sequenced information literacy curriculum for engineering
- Focus on one course
 - Illustrate approach in liberal arts environment
 - Provide details on faculty-librarian collaboration
 - First-year second semester course
 - Required of all engineering majors, 20-40 students
 - Mass and energy balances/stoichiometry/process engineering (ChemE) – uses Felder and Rousseau textbook

Course Objectives

Engineering
Calculations
Mass/Energy
Balances

Engineering
Ethics

Information
Literacy

Life Cycle
Assessment

Reflective
Judgment



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Information Literacy

- Students shall be able to:
 - Identify, access, and critically evaluate information
 - Use information effectively, ethically, and legally
 - Conduct searches for peer-reviewed journal articles and patents in appropriate databases
 - Properly attribute sources

Comparison with Traditional Courses

	NCSU	Smith
Technical Content	ChemE-focus	Engineering Science focus
Information Literacy?	Yes (not typical)	Yes
IL Topics	Sources of engineering data for process calculations, engineering handbooks	Broad introduction to engineering and sustainability research
Context	Mostly technical	Includes lifelong learning, reflective judgment, ethics

Learning Strategies: Librarian

- Librarian class tailored to LCA project
 - Computer classroom – interactive, hands-on
 - Catalog, interlibrary loan, databases for engineering and science literature
 - Internet searching, evaluation of sources
 - Search strategies applied to LCA project (handouts for developing keywords) – work in groups, report
 - Course-specific web resource, continued individual assistance



Learning Strategies: Faculty

- Assigned reading/discussion before librarian's class
 - motivates students to take information literacy seriously and cautions them against overconfidence
 - connects to reflective judgment, students motivated to develop critical thinking
- Homework assignment to practice information retrieval and evaluation (across topics)
 - patent search, database search, citation format usage, source evaluation, peer review, locating print journals, determining holdings, etc.
- Exam question for review



Integrated Reinforcement of IL

- Citation and support required in all problem sets and ethics case analyses
 - Reinforced importance of information literacy in other engineering contexts
- Life Cycle Assessment Project
 - Students assemble annotated bibliography (at least 5 peer reviewed sources, plus at least one book, patent, technical report, website). Reflect on source quality, reliability
 - Grade, iterative
 - Continued literature search
 - Final report – use of APA format and works cited list

Assessment

- Librarian-led class minute paper
 - Overall rating, highlight, fuzziest point
- Focus groups (on course overall)
- End of course evaluations
- Student course work



Librarian Class Minute Paper: Results

- All students rated overall learning experience as excellent or good
- Muddiest points:
 - use of interlibrary loan
 - referencing software (not focus of session)
- Highlights:
 - learning about databases and other resources on campus
 - learning how to navigate the libraries website (full text icon)
 - Use of interlibrary loan
 - Mechanics of search databases, patent databases, and search strategies

Librarian Class Minute Paper: Discussion

- Did not mention:
 - Evaluation of resources
 - Group activity for practicing search strategies
 - Need assessment tool revision to probe these
- Our impressions:
 - Many students not previously aware of resources available, despite first-year orientation and previous courses
 - Benefited particularly from search strategies
 - Presence of faculty member was important to communicate seriousness and to emphasize particular points relevant for upcoming assignments



Focus Groups

- Last third of semester
- All 24 students invited, 9 participants in 2 sessions
- 3 guiding questions on general learning in class (one on critical thinking)
- Thematic coding
- All IL-related data presented here



Focus Groups: Results

- Four of nine participants mentioned information literacy (unsolicited, in context of critical thinking)

Yeah, I definitely don't think I could have found the information I needed without the library briefing.

One thing that I found useful was that day when she was like 'So guys don't trust everything that's on the Internet' because it's... well of course don't do it but you do it all the time. And I don't think about it as much as I should. And so to have someone who tells you 'no, really, think about it' is really helpful.

One thing helpful about this class is that she encourages us to research a lot. And, as a first year and second semester it's kind of like you're still kind of figuring out how the library database goes and all that and online articles and finding reliable sources. So that's been kind of a learning experience that's been really helpful.

So, I guess the very first class Professor Riley talked about, you know, how do we learn and how do we know what we know is true... If you google something how do you know if this source is right, so I think critical thinking also has a lot to do with judgment...

Focus Groups: Discussion

- Information literacy is understood as an integral part of critical thinking, reflective judgment, and research
 - Not all students linked critical thinking with information literacy (5 of 9 did not)
- Students did not specifically mention the information literacy assignments or test questions
 - further probing is needed to determine their role in student learning
 - Librarian session did come up and was memorable and helpful



Course Surveys: Results

- Student self-assessment of objectives (1-5 Likert-type scale)
 - Mean scores ranged from 3.63 to 4.41
 - Students ranked learning community (teamwork) and basic engineering calculations the highest (4.41), and information literacy came in a close third with a mean of 4.35
 - One student comment: “definitely learned how to do this in this class.”
 - large standard deviations (0.65-1.05) preclude drawing definitive conclusions
- Open response: what surprised you?
 - Top answer: “ethics” (19 of 24 mentions)
 - Second-most common: mentions of “reflective judgment,” “critical thinking” or “effective researching” (4 of 24)
- Likes/Changes: Information literacy mentioned twice as a “like” – not as a change (LCA and ethics most common)

Analysis of Student Work: Homework

- Only 7 of 24 students were able to answer all questions correctly
- Common problems (gleaned from assignments and class discussion):
 - Following citations to previous work
 - Citing in APA format (missing volume numbers, dates, pages, patent number, etc.), cutting and pasting messy web links
 - Distinguishing between peer reviewed work and news articles about research, or original research vs. review articles
 - Evaluating authority of websites
 - Choosing appropriate source (e.g., technical term in language dictionary)
 - Using multiple sources
 - Using primary sources where available/preferable
 - Locating print journals in library (going to the library)
 - Interpreting results from the college library catalog



Analysis of Student Work: Tests and Projects

- Significantly improved performance on Test vs. Homework
 - All students demonstrated ability to use patent databases
 - Most could locate peer reviewed article by professor in the dept. -- some cited technical report (from cv rather than database)
 - Failure to enter library – small number, cited time constraints
 - Difficulty gleaning information from article – small number
 - Biggest difficulty: College holdings for a journal - online and print holdings require two separate searches, about half did not do both
- Students learned to cite data sources on problem sets
- Annotated bibliography
 - First iteration missing some source types, incorrect citation format, difficulty evaluating sources
 - Final drafts improved significantly (8-10 out of 10 for all reports), some missing citations, some overreliance on electronic sources

Conclusions

- Students improved information literacy skills
- Contributing Factors
 - Instruction from librarian
 - Reinforcement by professor in readings, class , homework, test, and project
 - Iteration – students need practice to improve skills
 - Integration - accountability across coursework, links to reflective judgment, lifelong learning, engineering ethics, technical material
 - Explicitness of discussion of IL, critical thinking and intentional learning
- Challenges
 - Liberal arts presumption that students already possess IL skills, reluctance to instruct in a skill (easier for engineering?)
 - Faculty commitment, especially for integration at this depth
 - Relationships!



Recommendations

- Resource intensive model
 - Faculty and librarians need time to prepare, conduct, and evaluate classroom interactions and assignments
 - Integrate information literacy with existing assignments (tests, projects, etc.)
 - Worth it! Investing resources does result in improved abilities
- Adaptability and scaling up
 - Feature and share faculty work
 - Gain faculty buy-in
 - sample assignments
 - recognition
 - incentives for participation
 - relationships

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