Does IL education have an impact on undergraduate engineering students’ research skills?

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Outline

1. IL
2. Pilot study
3. Research results
4. Conclusion
Information literacy
Principles of IL Education at LUT

1. Carried out by the Library staff without charging the faculties
2. Integrated in the curricula and carried out in close cooperation with faculties
   - each LUT faculty has its own Introduction to Studies course for first-year students and IL education is a compulsory part of that course
   - professors instructing Bachelor’s seminars (or other courses on which the students need to find source information) request the IL sessions from the Library
   - Master’s and PhD students attend their own teaching sessions which are more occasional and arranged upon request in connection with faculty’s courses
   - tailored IL education upon request
IL and research skills

How to turn the research problem into the process of information retrieval and use?
Pilot study

Does IL education have an impact on students’ research skills?
Pilot courses

Construction Materials Seminar
- Master’s level, in Finnish
- Substance → industrial application
- Global issue → where the research takes place → supporting language
- Where are the NEW scientific references?

Research Methods and Methodologies
- English Master’s level course
- Organized by the School of Mechanical Engineering
- Students learn how to plan scientific research project
- Students on this course formed a control group in part of the research
IL education content

- Characteristics of different information sources
- Selecting information sources for searching
- Selecting search words
- Combining search words
- How to use the Nelli portal (basics)
- Demonstration of searching information in ProQuest, Science Direct, Scopus
- Analyzing tool of Scopus
- Impact factors in Journal Citation Reports (JCR)
Pilot study

What is the starting level of the students' knowledge?

What is the effect of the tailored lecture?

What is the effect of the instructed hands-on searching session?

Research problem and research questions in the final paper

Qualitative analysis

Bibliometric analysis

References

Analysis of the substance and the content of the text

Professor’s comments
Results
# Changes in students’ searching behavior

<table>
<thead>
<tr>
<th></th>
<th>Before IL lecture</th>
<th>After IL lecture</th>
<th>After lecture and hands-on training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic form single words,</td>
<td>Truncated words</td>
<td>Truncated words</td>
<td></td>
</tr>
<tr>
<td>keyword-type words.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Word chains</td>
<td>Truncated words</td>
<td>Alternative search words (combined with OR)</td>
<td>Quotation marks indicating phrases.</td>
</tr>
<tr>
<td></td>
<td>Terms in full and their abbreviations (combined with OR)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No search strategy</td>
<td>Search strategies using Boolean operators.</td>
<td>Limiting the search term to title or keywords.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Limiting by document type.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Narrowing the search by viewpoint.</td>
<td></td>
</tr>
<tr>
<td>Foggy idea of combining words</td>
<td>Boolean operators</td>
<td>Advanced use of Boolean operators.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Parentheses</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Attention to impact factors</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Analyzing results, Scopus.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Using advanced search.</td>
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</tr>
</tbody>
</table>
Changes in the use of information sources

- Construction materials seminar, Finnish students
- separate lecture and hands-on training

Where do I plan to search, All Construction materials seminar students

- 1 Google Scholar: 19%
- 2 Nelli portal: 17%
- 3 Scopus: 17%
- 4 Library (Online catalog): 17%
- 5 Internet (Google): 8%
- 6 Science Direct (Elsevier): 5%
- 7 Other: 17%

Where did I search (Construction materials seminar research group)

- 1 Google Scholar: 13%
- 2 Nelli portal: 23%
- 3 Scopus: 23%
- 4 Library (Online catalog): 27%
- 5 Internet (Google): 14%
- 6 Science Direct (Elsevier): 23%
- 7 Other: SpringerLink, EBSCO, JCR...
Changes in the use of information sources

- Research methods and methodologies, international group
- combined lecture and hands-on training

Where do I plan to search (Research methods and methodology)

- Google Scholar: 33%
- Nelli portal: 10%
- Scopus: 7%
- Literature, library: 30%
- Internet (Google): 7%
- Science Direct (Elsevier): 3%
- Other: 10%

Where did I search (Research methods and methodology group)

- Google Scholar: 37%
- Nelli portal: 18%
- Scopus: 27%
- Literature, library: 9%
- Internet (Google): 9%
- Science Direct (Elsevier): 0%
- Other: 0%
Bibliometric analysis
- turned-in Construction materials seminar papers
- shares of cited sources

Research group
- Academic journal article: 58%
- Magazine: 18%
- Newspaper: 2%
- www-page: 6%
- Database: 4%
- Book: 6%
- Other: 6%

Comparison group
- Academic journal article: 29%
- Thesis: 14%
- Conference paper: 5%
- Other: 52%
Publication years of cited sources

- Research group
- Comparison group
How research problems and research questions were defined

<table>
<thead>
<tr>
<th>Before IL education, all groups</th>
<th>In the final paper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lists of concepts. Single words in basic form. One group presented a why-question but no research problem. Students did not understand the question. They answered by giving the title of the paper.</td>
<td>Research groups Two groups presented a clear determination of both the research problem and the research questions. One group presented their research problem less clearly but it could be found in the abstract of the paper.</td>
</tr>
<tr>
<td>Comparison group</td>
<td>No noticeable definition of the research problem or research questions.</td>
</tr>
</tbody>
</table>
## Professor’s view

<table>
<thead>
<tr>
<th>IL educated students</th>
<th>Students with no IL education</th>
</tr>
</thead>
<tbody>
<tr>
<td>present a dialogue with the found references</td>
<td>copy-paste text, nearly plagiarism, bulk text to meet the amount requirements</td>
</tr>
<tr>
<td>formulate and analyze the research problem</td>
<td></td>
</tr>
<tr>
<td>discuss reasons and consequences of different phenomena</td>
<td>present just the existing facts without any interpretation or own thoughts</td>
</tr>
<tr>
<td>describe the development of the topic in a logical timeline / present the results either in a comparison or SWOT analysis table</td>
<td></td>
</tr>
<tr>
<td>are aware that some references support their results but some might present even opposite viewpoints</td>
<td>mostly look for references which best support their own ideas and thoughts</td>
</tr>
<tr>
<td>use references to form background, present cases, verify conclusions</td>
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</table>
Key findings

After IL education
• information searches improved
• the quality of found and used sources improved
• students expressed deeper handling of the subject
• students understood better how to turn the research problem into the process of information retrieval and use

However,
• the study should be repeated in a larger scale to ensure the findings
• to verify the results the study should be extended to other disciplines but mechanical engineering
It is not just punching the keyboard. It is a mindset!