# Teaching a systematic approach to literature research: effective use of blended learning and integrated education

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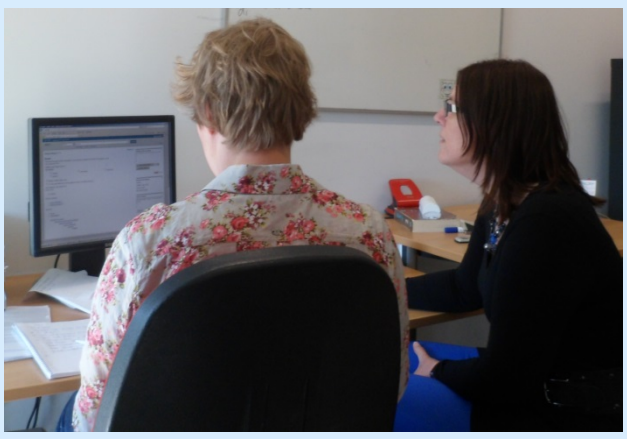
## Introduction

At Leiden University Medical Center, information specialists teach information literacy to medical and biomedical science students. In many places, students are simply taught basic searching skills, using the basic search possibilities of bibliographical databases. This results in less than optimal information literacy skills and literature searches which do not meet scientific demands such as reproducibility. The process lacks efficiency and the results of this kind of literature research are a weak basis for evidence-based practice and future research.

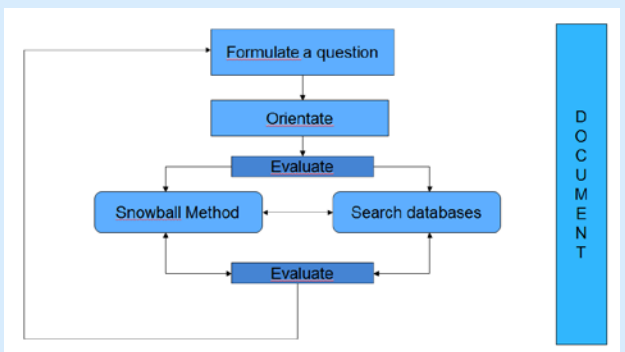
Therefore, we have chosen to teach students the systematic and advanced system of literature research our team of information specialists uses. From the initial formulation of a question to the final documentation of the search process, every phase of the research process is clear and reproducible. To achieve this high level of skills, requires motivating and extensive training of end-users by information specialists.



Information specialist and course coordinator trying out PubMed searches for integrated education.

The education we offer is based on the ACRL norms for information literacy[1] and integrated into the curriculum. Blended learning and integrated education contribute to students' motivation and to their mastering of information literacy skills

## Our systematic approach to searching for information

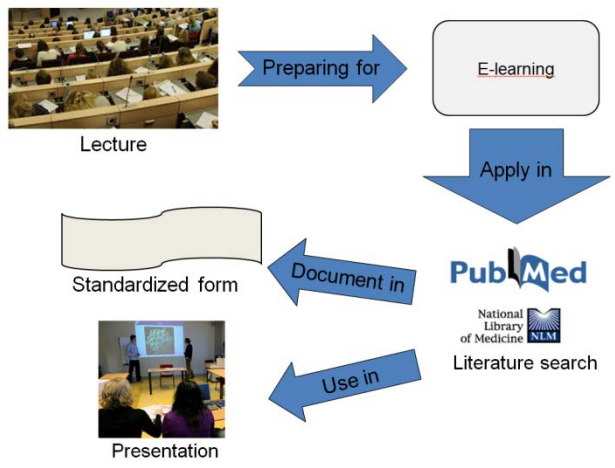



1. Searching systematically starts with formulating a question, mostly with help of PICO.[2]
2. The question is separated into components. Often, each component is related to one element of PICO.
3. For each component, systematic subjects headings (according to the database) and free text terms are combined with OR.
4. Then, components are combined with AND to form one search strategy.
5. Depending on the yield and the required sensitivity or specificity, this search strategy can be adapted by

- adding or leaving out components
- focusing by means of major subject headings instead of all subject headings and free text in title/abstract instead of all fields.
- using filters or clinical queries

## Blended learning

Our biomedical science students start their academic scientific training, including literature research, in the first week of the bachelor phase and improve their skills every year.[3] We make use of blended learning[4,5] to enhance study results. In our case, this means that we make use of several learning modalities to make optimum use of all and address students with different learning styles.




- Lectures are given to set goals and define outlines of the course. Using examples from the LUMC research programmes, scientific practice comes to life, and triggers the motivation of the students.
- E-learning is used to offer large numbers of students hands-on practice. Immediate feedback is given by the system and often, teachers are present to support when necessary. The e-learning can be used by both students and other interested people 24/7 as it is accessible with a free account from the Dutch biomedical e-learning database on the internet.
- In an assignment, information literacy skills are applied to a specific topic, relating to the course themes. The result of the literature research is input for a presentation or another project within the course.
- The literature research is done with a detailed manual. The search question, sources for orientation, PubMed searches and resulting references are documented in a standardized format which is graded by the teacher using a scoring rubric.[6]
- The filled-in rubrics are sent to the students to give rich feedback on individual performance.

| | Level 1 | Level 2 | Level 3 |
|---|---|---|---|
| Objective A | performance | performance | performance |
| Objective B | performance | performance | performance |
| Objective C | performance | performance | performance |

## Integrated education

Themes are taken from the courses we contribute to and references retrieved in the information literacy assignments are used as input for presentations or other projects within the same course. Information literacy it not separated from biomedical courses into pure information literacy workshops or assignments but forms an integrated part of the course. Applying information literacy skills immediately to biomedical themes enables the students to see their value and retain the skills.

## Example: Start.BW

In the opening course Start.BW of the study Biomedical Sciences, melanoma skin cancer is the overall course theme as the course coordinator is a researcher in the field of melanoma and chair of the Dutch Melanoma Patient Organization. She recently asked the help of the information specialist, to find the necessary literature to update a guideline on melanoma.

- This cooperation between a biomedical scientist and an information specialist is used as an example in the general **introductory lecture** on information literacy.
- The theme of the consecutive **e-learning** is ultraviolet light as a risk factor for melanoma. The e-learning comprises the whole process, including searching the library catalogue and PubMed. The computer based e-learning is performed in classrooms with assistance of a teacher if needed.
- Subsequently, in pairs, students do a **literature search** to obtain back-ground information on a research question related to melanoma.
- Students report on their searches in a **standardized format** in order to be **graded for information literacy**.
- They finally **present** the research question related answers to their peers to to be graded for scientific knowledge dissemination.

## Challenges

Motivating students for basic scientific skills is a well-known challenge that information specialists share with statisticians. [7,8]

Developing educational materials and teaching a diverse range of groups requires good educational skills and training, which we experience as an enrichment of our profession. All of the members of our team are qualifying for a basic certificate for university tutors . Preparing integrated education requires close collaboration with course coordinators and other colleagues in the course team, because more than superficial knowledge of the course topic is required to formulate assignments which cover both information literacy aspects and biomedical aspects. Building such a strong cooperation is a process of years.

Keeping the educational materials up-to-date is a continuous and time-consuming process. Recent changes in PubMed and Web of Science were implemented just before major educational activities, posing a real challenge to our team.

## Positive outcomes

Based on course evaluations and on literature[5,7,8], we have learned that both our approach of blended learning and the integration of information literacy in the students' curriculum**,** enhance students' motivation and educational performance. As a result, students can search for literature to support grant proposals and they know how to do a scientifically sound literature research for reviews and guidelines. We support PhD students and staff members in our institution by providing manuals and other sources of information on the methods of literature research and we assist individuals in comprehensive searches. Graduates are information literate but they need to keep up to date. They can continue to develop their skills by using our e-learning, manuals and summaries of recent changes.

Bachelor student signing faculty graduates book.

## References

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