

## About Project-Based Learning (PBL)

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Because engineers work in projects, engineering is best learned through projects (Prince and Felder 2006). This is usually called project-based learning (PBL), which is centred on the learning that emanates from a real engineering project. The *learning* is more important than the *solution* of the project.

In Project Based Learning, you will spend much of your time *learning* – by:

- identifying what you need to know,
- finding out (from the library, internet, colleagues, etc),
- teaching each other, and then
- applying your new knowledge to the project.

Thus, the primary aim of the exercise is the *learning*, not the completion of the project. The project is the means to this end.

Project Based Learning encourages *independent and interdependent learning* and a deeper understanding of the material, rather than superficial coverage. It will give you practice in tackling engineering problems and defining your own gaps in understanding in the context of those problems.

Most importantly, you learn to tackle problems you haven't seen before. That is the nature of engineering practice.

### Competency being developed

Engineers Australia (Engineers Australia 2017) expresses this competency for *lifelong learning* as:

#### 3.5 Orderly management of self, and professional conduct.

- a) Demonstrates commitment to **critical self-review** and **performance evaluation** against appropriate criteria as a primary means of tracking personal development needs and achievements.
- b) Understands the importance of being a **member of a professional and intellectual community**, learning from its knowledge and standards, and contributing to their maintenance and advancement.
- c) Demonstrates commitment to **lifelong learning** and professional development.
- d) **Manages time** and processes effectively; prioritizes competing demands to achieve personal, career and organisational goals and objectives.
- e) **Thinks critically** and applies an appropriate balance of logic and intellectual criteria to analysis, judgment, and decision-making.
- f) **Presents a professional image** in all circumstances, including relations with clients, stakeholders, as well as with professional and technical colleagues across wide ranging disciplines.

### Skills developed

The small group setting used in PBL encourages an inquisitive and detailed look at all issues, concepts and principles contained within the problem. The time spent outside of the group setting facilitates the development of skills such as literature retrieval, critical appraisal of available information and the seeking of opinions of peers and specialists. PBL encourages you to become more involved in, and responsible for, your own learning.

PBL will provide you with the opportunity to develop the following skills:

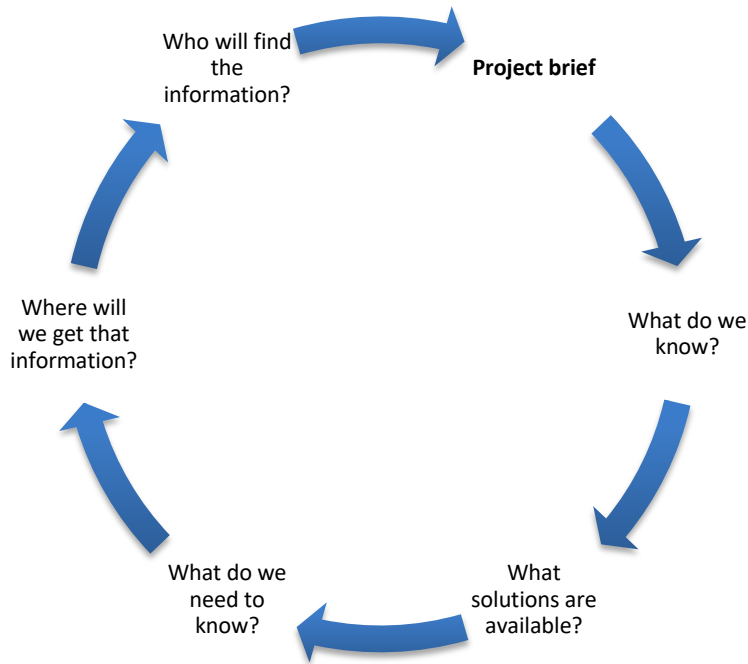
1. Problem solving skills
2. Thinking skills
3. Teamwork skills, including appreciating diversity of group members
4. Time management skills
5. Information retrieval and evaluation skills
6. Communication skills
7. Computing skills

Through your project work, you will also be learning to *be* an engineer. This requires the development of professional attitudes such as item (f) above:

f) **Presents a professional image** in all circumstances, including relations with clients, stakeholders, as well as with professional and technical colleagues across wide ranging disciplines.

## A Problem-Solving Process

There are many ways of describing how to *do* project-based learning. In solving any problem, it's useful to have a bit of mental software that helps you get started and keeps you going towards the answer. This process has been adapted from (Landsberger 2007) and it provides the strategy for solving problems. It is a variant of the engineering method (Hadgraft 2007):



1. Explore the problem, e.g., read the project brief and discuss with group members.
2. List “What do we know?” – brainstorm among the group members – sticky notes and butchers paper are wonderful aids in this process
3. Try to write the problem statement in your own words – what are you asked to do?
4. List possible solutions.
5. List “What do we need to know about these possible solutions?” What are your knowledge (and data) gaps?
6. Where will we find that sort of information?
7. Who will do which parts of the additional research? (Write an action plan)  
(At the next meeting) return to step 2 with new information. This may alter the problem statement and the range of possible solutions (3, 4). Otherwise, if the job is done, proceed to step 8.
8. Document your solution
9. Review your performance

What do we know?	What are possible solutions?	What do we need to know?	Where will we find this?	Who will find out?

**This process always lets you get started**, even with a problem you've never seen before. The worst-case scenario is that you'll have to go and do some research about the problem, usually on the Internet, but occasionally in the library.

The PBL method relies on a *divide and conquer* approach to gathering new information. Team members can each do some of this job and then at the next meeting *share* the new information with the group members.

It is important to prepare a *summary* of what you have learned. This might be a Word file, a mindmap, a diagram, or all these things. This can be emailed to group members as well as uploaded to the group's website where all the project documents are kept. This is helpful in case people miss meetings and so that they can refresh their memories about what you said three weeks ago. A wiki makes a good team website or you can use MS Teams, Facebook, Dropbox, and many others.

It is tempting to send these files around via email. However, emails get lost, and they are very hard to search and find again. That's why a team *document repository* is so useful. When you go to work, you'll discover that's how engineering companies work now.

Use a free wiki site such as: <http://pbworks.com> to organise your group documents or Google Docs or Dropbox or Basecamp or ... there are many options.

Have a look at FreeMind as a free mindmapping tool:

[http://freemind.sourceforge.net/wiki/index.php/Main\\_Page](http://freemind.sourceforge.net/wiki/index.php/Main_Page)