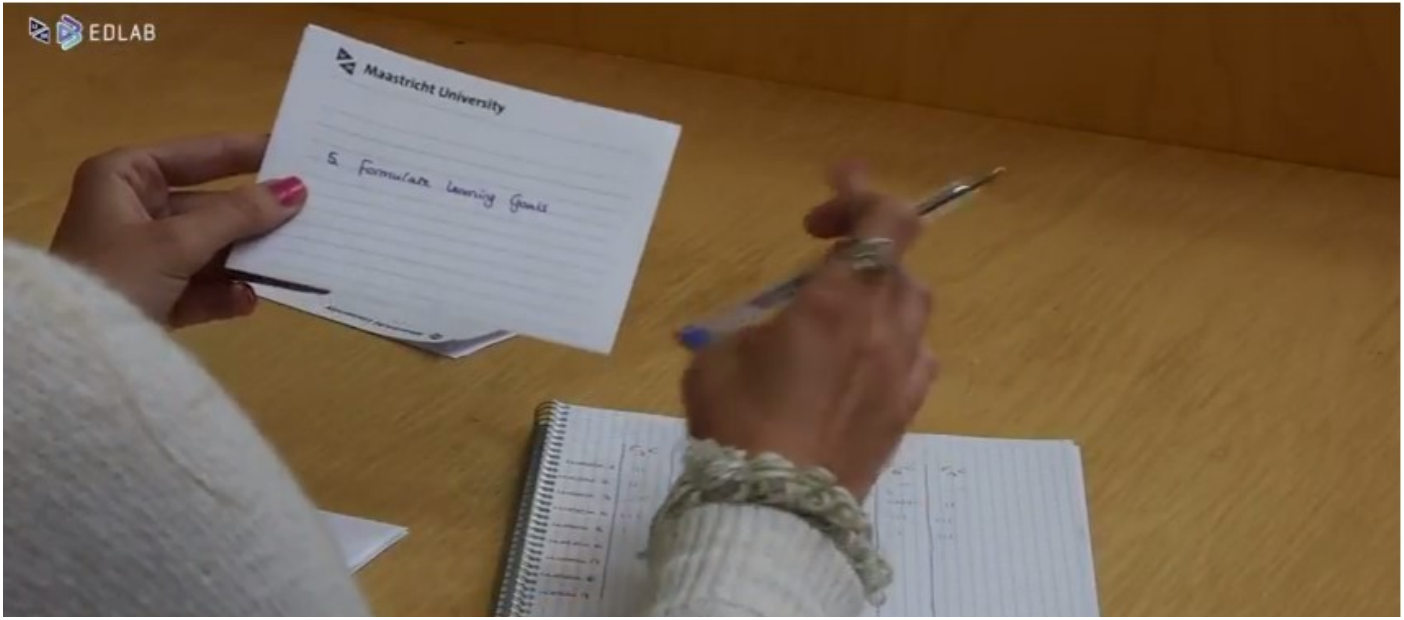
Practice testing

Self-testing or taking practice tests over to-be-learned material



Scientific evidence for this technique is:
High

Amount of training required:
Minimal

How to make the most of Practice testing

Students can self-test with flashcards, old exams or by using the Cornell system: during class or when you take notes, make a column on one edge of the page where you enter key terms or questions. You can test yourself later by covering the notes and answering the questions (or explaining the keywords) on the other side. Make sure that you challenge yourself during practice testing, don't make the questions too easy. And check, whether your answers were correct; feedback about your performance makes practice testing even more effective.

Applicability in PBL

High: before, during, after tutorial meetings: asking and answering questions. Check whether your answers are correct! You can also exchange your questions or flashcards with your fellow students or ask each other questions.

Distributed practice

Implementing a schedule that spreads out study activities over time

Scientific evidence for this technique is:
High

Amount of training required:
Planning required

How to make the most of Distributed practice

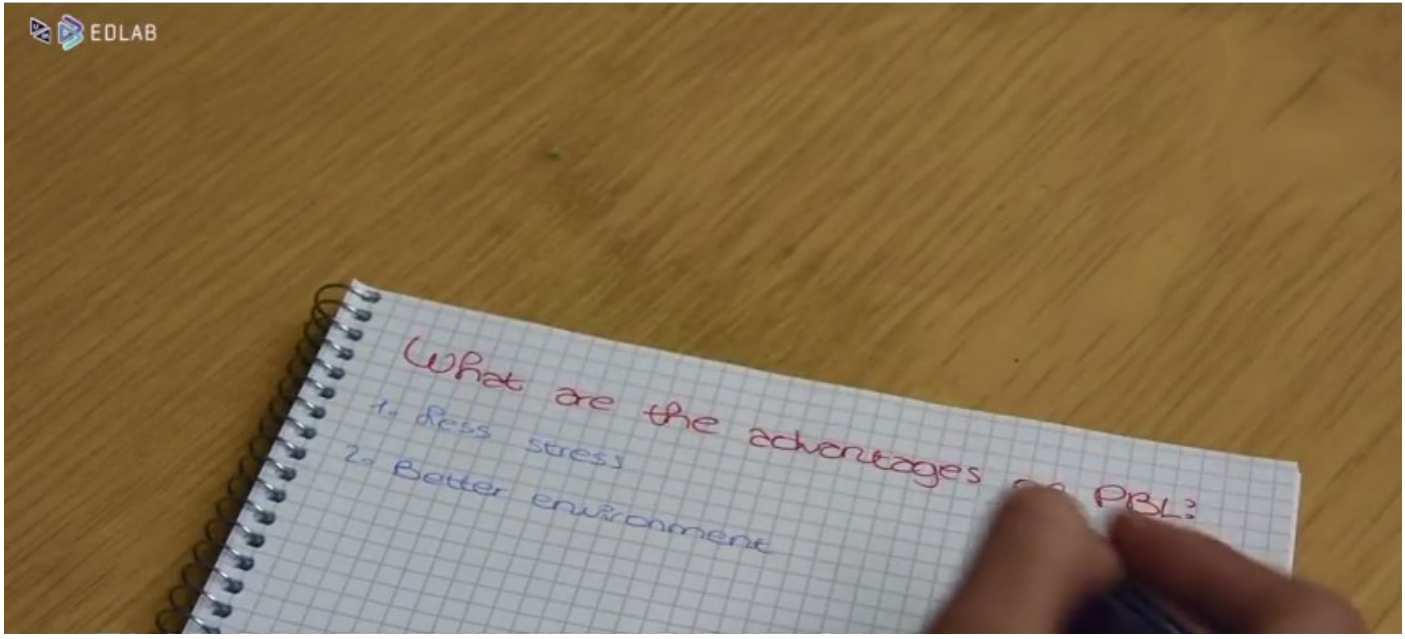
Longer intervals are generally more effective. In one study, 30-day delays improved performance more than lags of just one day. In an Internet-based study of trivia learning, peak performance came when sessions were spaced at about 10 to 20 percent of the retention interval. To remember something for one week, learning episodes should be 12 to 24 hours apart; to remember something for five years, they should be spaced six to 12 months apart. Although it may not seem like it, you actually do retain information even during these long intervals, and you quickly relearn what you have forgotten. Long delays between study periods are ideal to retain fundamental concepts that form the basis for advanced knowledge.

Applicability in PBL

High: You already distribute your learning sessions through the structure of PBL. Make sure that you repeat also learning content from the previous week. How about to add a 15 min repetition session every week to your learning schedule?

Elaboration

Explain and describe ideas with many details and connect it to what you already know



Scientific evidence for this technique is:
Moderate

Amount of training required:
Minimal

How to make the most of Elaboration

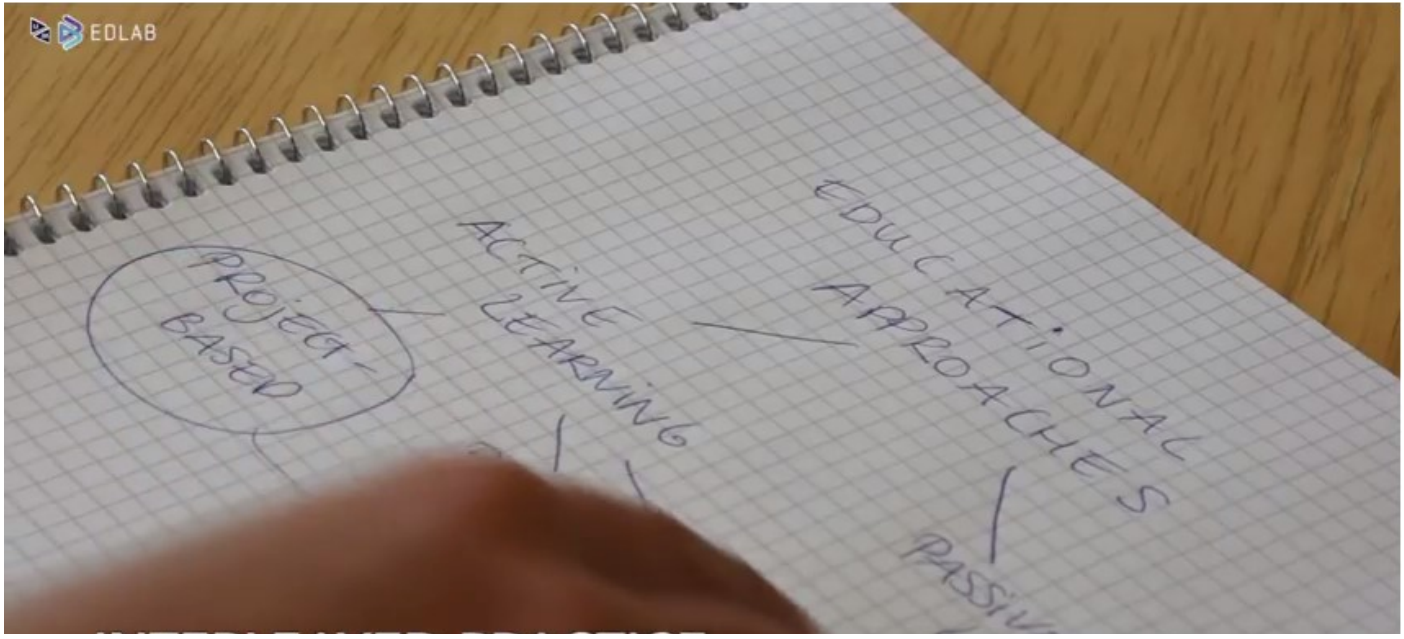
Ask yourself questions while you are studying or reading a text, for example how things work and why. Explain things out loud to yourself or your peers. When you explain to yourself, it is helpful to use multiple concrete examples to illustrate abstract concepts. Think about how things you learn are connected to each other and with things you already know. Can you relate the topics of the current block with things you have learned previously? Make sure that your elaborations are correct, check with your peers or your tutor whether you have understood a concept correctly.

Applicability in PBL

High: Before and during tutorial meetings, or when reading a text during self-study asking yourself 'how' and 'why' questions or answering someone else's

Interleaved practice

Switch between ideas and problems within one study session



Scientific evidence for this technique is:
Moderate

Amount of training required:
Planning required

How to make the most of Interleaved practice

Switch between ideas and problems during one study session. Don't study one idea too long. Go back to the ideas again in different orders in order to strengthen your understanding. Make links between the different ideas as you switch between them. But keep in mind: while it's good to switch between ideas, don't switch too often, or spend too little time on one idea; you need to make sure you understand it. And: Interleaving will feel harder than studying the same thing for a long time, but it is actually helpful for learning because you have to think about the idea again and again.
Blocked practice—doing all the items from one category in a row—may be more effective when the examples are not very much alike because it highlights what they have in common.

Applicability in PBL

Moderate: useful when learning topics or problems that have similar characteristics.

Visualization

Scientific evidence for this technique is:
Moderate

Amount of training required:
moderate

How to make the most of Visualization

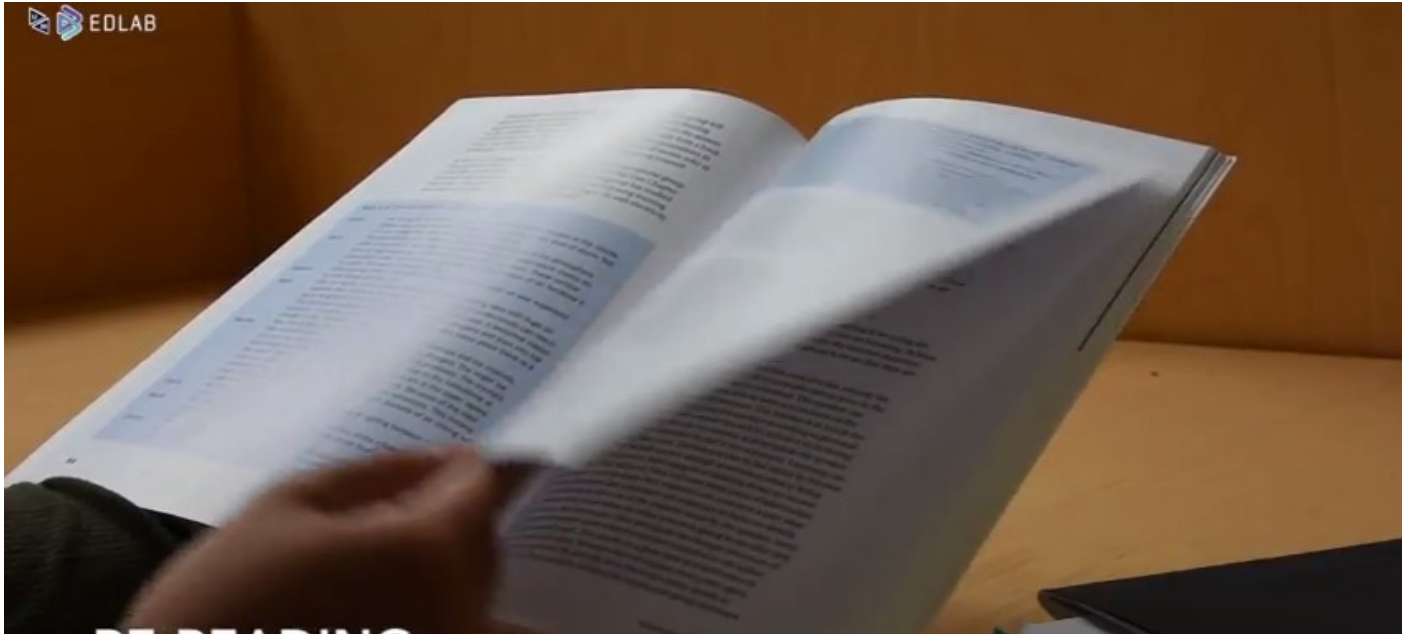
Don't rely on images and making visualizations only. Try the **dual-coding** technique: when reading a text, make a visual out of it (graph/diagram/mindmap); when studying a graph or visual, then explain it in your words. Combine it with practice testing and try to write and draw from your memory. That way, you make visualization more effective.
Keep in mind: there is no such thing as visual learners, visualization can work as another form for elaboration, but it does not suit one student better than the other.

Applicability in PBL

Moderate. Always combine visualization with more effective strategies: draw a picture of a process from your memory and check, whether you included all important parts; or explain a visualization out loud to yourself or your peers.

Re-reading

Restudying text material again after an initial reading



Scientific evidence for this technique is:
Low

Amount of training required:
No

How to make the most of Re-reading

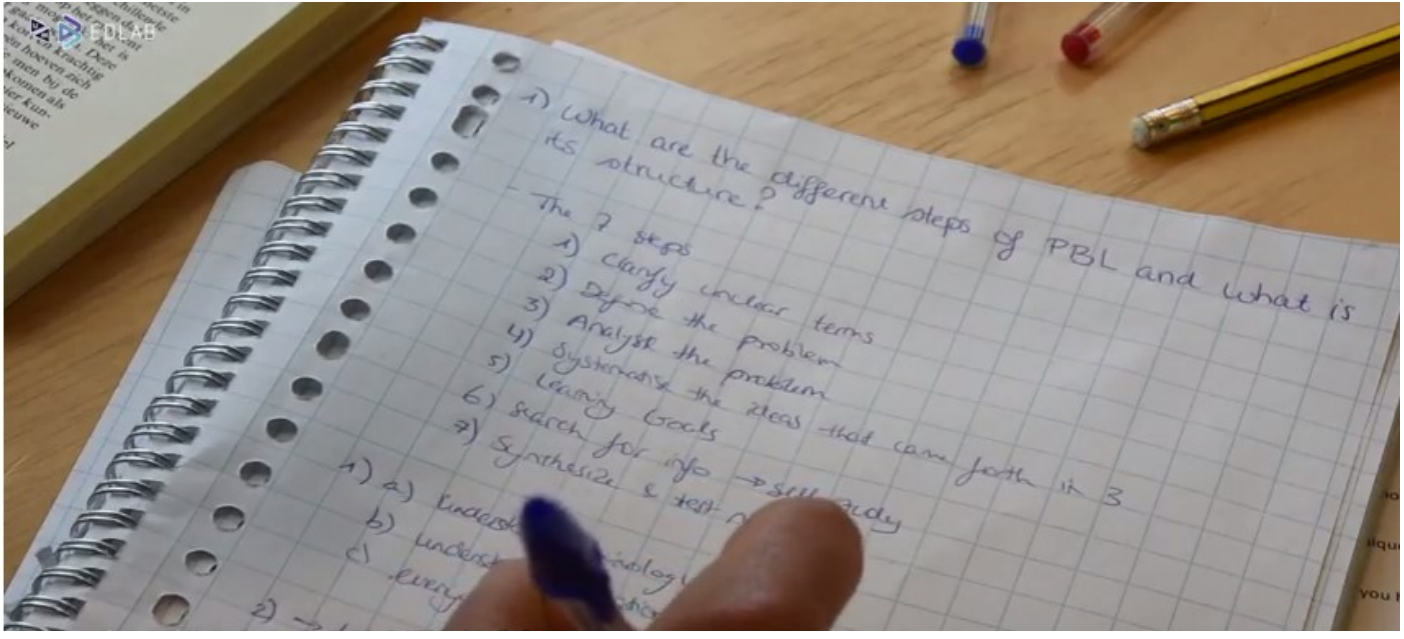
Rereading texts or learning material is a low effective strategy for long-term learning. Don't waste your time and only reread your summaries before an exam. You can make it more effective when you space out the reading intervals and plan the second reading after a 2-5 days. The longer the interval between the readings, the more you have forgotten and get stimulated to think actively about the content. Try to always combine rereading with self-explanation or asking yourself questions about the text. It is important to actively check whether you understand what you read and whether you can retrieve it, without the text in front of you.

Applicability in PBL

Low: always combine rereading with other strategies, such as elaboration or practice testing!

Summarization

Writing summaries (of various lengths) of to-be-learned texts



Scientific evidence for this technique is:
Low

Amount of training required:
Very difficult to learn to do well

How to make the most of Summarization

Self-made summaries help you prepare for post-discussions, but are not enough for long term learning. Simply copy-pasting does not help you to remember. You might have all important information in your summary, but not in your memory!
If you make a summary, write it in your own words, identify the main points and explain the concepts to yourself while writing. When you take notes during a lecture, make sure to review the notes again. Or use the Cornell system (see practice testing) and combine your summaries with practice questions.

Applicability in PBL

Moderate: Helpful in post discussion, but not sufficient for long term learning! Combine with effective strategies. Or try to close your laptop during post-discussion. You have written a summary, can you remember what you wrote and participate in the post-discussion without it?

Highlighting

Marking potentially important portions of to-be-learned materials while reading

Scientific evidence for this technique is:
Low

Amount of training required:
No

How to make the most of Highlighting

Highlighting or underlining can be useful if it is the beginning of a journey—if the marked information is then turned into flashcards or self-tests. The problem with highlighting is that students often overmark texts. However, there is no scientific evidence, that this is helpful for long-term learning. Highlighting can help you to stay concentrated on the text while re-reading, but it does not help you to remember the highlighted information better.

Applicability in PBL

Low. If you cannot stop highlighting, always combine it with more effective strategies: take a highlighted text and explain the highlighted key terms to yourself or your peers, elaborate on the highlighted concepts or make flashcards out of it and test yourself!