

## Appendix A

# Student-centred teaching

## Description

Student-centered teaching shifts the focus from the teacher to the student. Students actively participate in decisions about what, when, and how they learn. SCL aligns learning experiences with students' interests, and uses assessment to guide students' progress.

Advantages	Challenges
<ul style="list-style-type: none"> <li>• Embedded into a course</li> <li>• Trains many different competencies</li> <li>• Aligns with employability skills</li> <li>• Already present in many programmes</li> </ul>	<ul style="list-style-type: none"> <li>• Usually a setting with already a lot of different elements, competencies and assignments</li> <li>• Implicit personal development process</li> <li>• Student attendance/engagement can remain weak (only the bare minimum)</li> </ul>

## Personal development process

Ways to use the intervention to support the different phases of the students' PDP process:

Identify strengths and weaknesses	<ul style="list-style-type: none"> <li>• Use appropriate tests and/or self-assessment (subject matter, teamwork, personality etc.) to identify the starting level of the students</li> <li>• Use learning outcomes to help students identify gaps in their knowledge</li> </ul>
Prepare a plan for learning	<ul style="list-style-type: none"> <li>• Make students set their own learning goals</li> <li>• Co-create learning materials list (books, podcasts etc.)</li> <li>• Make students think how they learn the best and how to use that knowledge during the course</li> </ul>
Act by executing the learning plan	<ul style="list-style-type: none"> <li>• Follow and encourage student attendance and activity</li> <li>• Have students report on the use of different learning materials</li> </ul>
Monitor the learning process	<ul style="list-style-type: none"> <li>• Milestone evaluations on goal achievement</li> <li>• Use peer-assessment to provide feedback</li> <li>• Re-do the assessments in the identify-part</li> </ul>
Reflect on the process and what is next	<ul style="list-style-type: none"> <li>• Make students describe and explain their progress towards the goals</li> <li>• Have students create learning material for new students (what would you focus on, why and how)</li> </ul>

## Good support for LLL competencies:

- Locating and scrutinizing information
- Self-monitoring
- Creating a learning plan
- Willingness, motivation and curiosity to learn
- Self-reflection

# ePortfolio

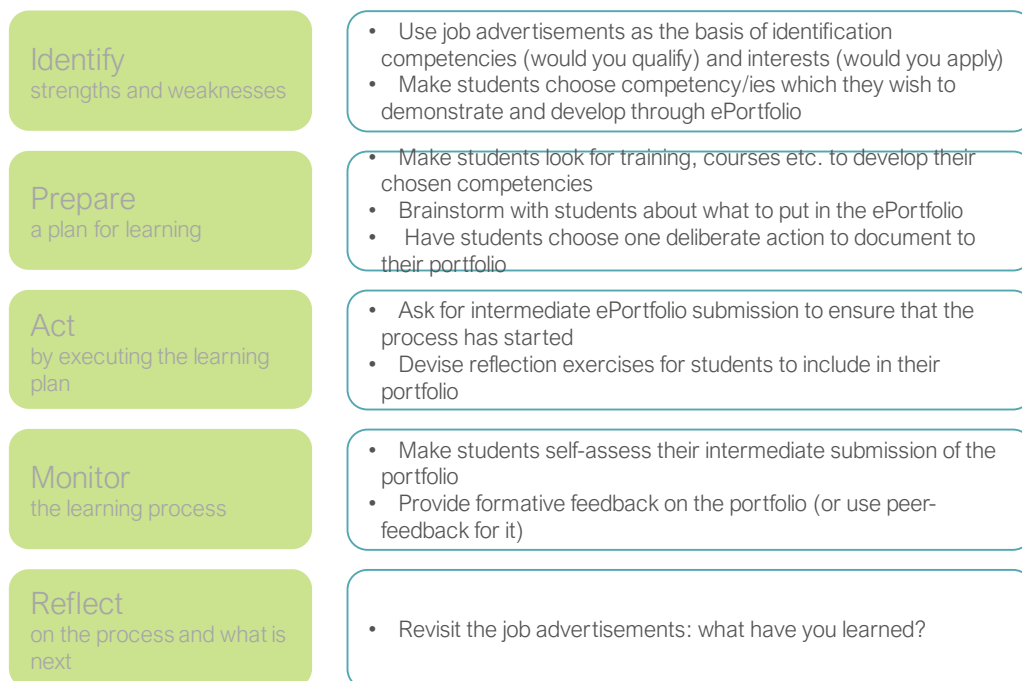
## Description

An ePortfolio is an evolving electronic/online collection of artifacts of learning and reflection for an individual learner with which the learner can showcase personal and/or professional growth over time.

Advantages	Challenges
<ul style="list-style-type: none"> <li>• Applicable to many different courses</li> <li>• Can be used also across courses/modules</li> <li>• Requires only a little class time</li> <li>• Storing the showcases of learning requires no extra work from students</li> </ul>	<ul style="list-style-type: none"> <li>• Need for an online platform or tool</li> <li>• Can be challenging to evaluate</li> <li>• Producing the reflective parts can require extra effort from students (if not embedded in the course otherwise)</li> </ul>

## Personal development process

Ways to use the intervention to support the different phases of the students' PDP process:



## Good support for LLL competencies:

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# Peer or self-assessment

## Description

In peer or self-assessment students evaluate their peers and/or their own competencies. Assessment can be formative (feedback) or summative (grading) and it can include qualitative and/or quantitative information. Usually, it is a good idea to support the assessment process with a rubric or some other kind of explicit instruction.

Advantages	Challenges
<ul style="list-style-type: none"> <li>• Embedded into a course</li> <li>• Can include all types of competencies</li> <li>• Can be used cross-curricular</li> <li>• Can replace (part of) teacher's feedback (and save thus time)</li> </ul>	<ul style="list-style-type: none"> <li>• Can be influenced by team dynamics or social desirability</li> <li>• May not be taken seriously and/or is done with minimum effort</li> <li>• Implicit personal development process</li> </ul>

## Personal development process

Ways to use the intervention to support the different phases of the students' PDP process:

Identify strengths and weaknesses	<ul style="list-style-type: none"> <li>• Use SWOT-based rubric to guide self/peer-assessment</li> <li>• Combine self-, peer-, and teacher assessment into 360-type of assessment</li> <li>• Co-create an assessment rubric with the students</li> </ul>
Prepare a plan for learning	<ul style="list-style-type: none"> <li>• Ask students to set an improvement goal(s) based on self/peer assessment</li> <li>• Have students devise an action plan based on self/peer-assessment</li> </ul>
Act by executing the learning plan	<ul style="list-style-type: none"> <li>• Give students an opportunity to improve their work (i.e. put self/peer assessment into use)</li> <li>• Make students help their peers in improving their work</li> </ul>
Monitor the learning process	<ul style="list-style-type: none"> <li>• Repeat the original peer/self-assessment &amp; have the student compare the results</li> <li>• Make students respond to the original assessment: what have I done based on the feedback</li> </ul>
Reflect on the process and what is next	<ul style="list-style-type: none"> <li>• Make students respond to the original assessment: what should I do next time to get a better assessment</li> <li>• Introduce principles of good feedback and have students evaluate the self/peer-assessment they have delivered</li> </ul>

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# Reflective journals or logs

## Description

Reflective journal or log is a collection of thoughts, feelings, observations, notes, and other related resources created over time. Its purpose is to encourage students' critical and reflective thinking. Students can be asked to submit the entire journal or a summary or excerpts from it.

Advantages	Challenges
<ul style="list-style-type: none"> <li>• Applicable to many different courses</li> <li>• No class time except for a short introduction</li> <li>• Short time investments from the teacher</li> </ul>	<ul style="list-style-type: none"> <li>• Require sustained investment from the student</li> <li>• Can be challenging to evaluate</li> <li>• Engineering students often not used to reflect</li> </ul>

## Personal development process

Ways to use the intervention to support the different phases of the students' PDP process:

<b>Identify</b> strengths and weaknesses	<ul style="list-style-type: none"> <li>• Use prompts (e.g. digital polling tools) to invite ideas and opinions and illustrate that there are no right and wrong answers</li> <li>• Present a list of (exemplary) questions, with which students can get the writing going</li> </ul>
<b>Prepare</b> a plan for learning	<ul style="list-style-type: none"> <li>• Ask students to plan, when, where, and how they are going to write their reflective journal</li> <li>• Invite students to set a personal goal for writing</li> </ul>
<b>Act</b> by executing the learning plan	<ul style="list-style-type: none"> <li>• Connect a reflective journal and a practical project → identify &amp; prepare parts in a log &amp; execution during a project, monitoring and reflection in a log</li> <li>• Use a "minute-paper" in the class to produce the opening text in the reflective journal (e.g. what do I expect to learn from writing)</li> </ul>
<b>Monitor</b> the learning process	<ul style="list-style-type: none"> <li>• Ask students to self-assess their journal / part of it using the same rubric which will be used for the final assessment</li> </ul>
<b>Reflect</b> on the process and what is next	<ul style="list-style-type: none"> <li>• Ensure that the instructions and assessment criteria of the reflective journal allow for genuine reflection and don't invite "teacher-probably-wants-to-hear-this" texts</li> </ul>

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# Mentor guidance

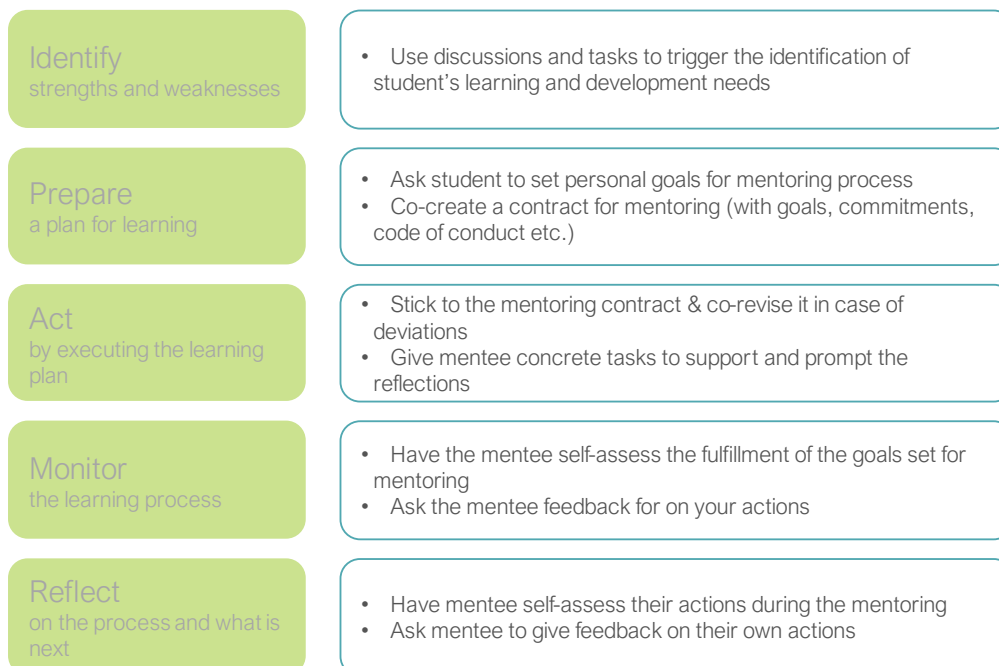
## Description

Mentor guidance means personal interaction between the teacher/mentor and the student/mentee in which the mentor orientates the mentee's development process with prompts, tasks, and questions but avoids direct orders.

Advantages	Challenges
<ul style="list-style-type: none"> <li>• Personal guidance is often effective</li> <li>• Creates a closer relationship between lecturer and student</li> <li>• Problems can be easier to address in discussion than in written form</li> </ul>	<ul style="list-style-type: none"> <li>• Large time investment from lecturer</li> <li>• Requires specific competencies from the lecturer</li> <li>• Requires certain level of trust and familiarity between the partners</li> </ul>

## Personal development process

Ways to use the intervention to support the different phases of the students' PDP process:



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# (Progress interview with) Role play

## Description

In progress interviews with role play students discuss their personal development with their peer, who plays the role of a mentor. In discussion the focus shifts from an end product (like reflective journal) to the process of explaining the development. Interestingly, the students reported the role-play progress interviews to be more valuable than the mentor interviews.

Advantages	Challenges
<ul style="list-style-type: none"> <li>• Personal guidance is often effective</li> <li>• Smaller time investment from the lecturer than with individual mentor guidance</li> <li>• Opening up to a peer can be easier</li> <li>• Students in both roles learn</li> </ul>	<ul style="list-style-type: none"> <li>• Requires an effort from the students</li> <li>• Requires sufficient trust and respect from the students</li> <li>• Challenging to assess</li> </ul>

## Personal development process

Ways to use the intervention to support the different phases of the students' PDP process:

Identify strengths and weaknesses	<ul style="list-style-type: none"> <li>• Prepare a list of questions/discussion prompts for the mentor to invite the mentee to talk about their strengths and weaknesses</li> </ul>
Prepare a plan for learning	<ul style="list-style-type: none"> <li>• Ask the mentoring pairs to agree upon goals and a code of conduct for the exercise</li> </ul>
Act by executing the learning plan	<ul style="list-style-type: none"> <li>• Ensure that role play is carried out as expected (observe, require some format of documentation etc.)</li> </ul>
Monitor the learning process	<ul style="list-style-type: none"> <li>• Instruct the pair to evaluate the reaching of their goals at the end of the exercise</li> <li>• Instruct the pair to evaluate the following the code of conduct at the end of the exercise</li> </ul>
Reflect on the process and what is next	<ul style="list-style-type: none"> <li>• Invite the mentor to ask mentee self-assess their actions during the mentoring</li> <li>• Instruct the mentor to ask mentee to give feedback on their actions</li> </ul>

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# Digital storytelling

## Description

Digital storytelling can be described as the use of text, images, video, and audio to present a personal development within the context of a course or a general topic. Digital storytelling has been noted to result in more engagement than a written form of assignment.

Advantages	Challenges
<ul style="list-style-type: none"> <li>• Can be more motivating for students than written assignments (room for creativity)</li> <li>• Allows for multiple formats of self expression → accommodates diverse students</li> </ul>	<ul style="list-style-type: none"> <li>• Diverse formats can be challenging to assess</li> <li>• Possible technical challenges in opening the different file-formats etc.</li> </ul>

## Personal development process

Ways to use the intervention to support the different phases of the students' PDP process:

<b>Identify</b> strengths and weaknesses	<ul style="list-style-type: none"> <li>• Use strengths and weaknesses as a topic of a digital storytelling assignment</li> </ul>
<b>Prepare</b> a plan for learning	<ul style="list-style-type: none"> <li>• Use digital storytelling as a format in student's learning plan</li> <li>• Ask students to make a plan about their digital storytelling production</li> </ul>
<b>Act</b> by executing the learning plan	<ul style="list-style-type: none"> <li>• Have students to introduce their digital storytelling production plan and (intermediate) results to their peer</li> </ul>
<b>Monitor</b> the learning process	<ul style="list-style-type: none"> <li>• Ask students to monitor their progress / learning with means of digital storytelling</li> <li>• Ask students to self-assess their digital story (e.g. against their production plan)</li> </ul>
<b>Reflect</b> on the process and what is next	<ul style="list-style-type: none"> <li>• Ask students to reflect upon a specific learning event / task / challenge through digital storytelling</li> </ul>

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# Reflective essay

## Description

A reflective essay is a personal piece of writing exploring learner's experiences, thoughts, and what they have learned from them. Unlike academic essays, the reflective essay focuses on one's unique experience and perspective rather than external sources.

Advantages	Challenges
<ul style="list-style-type: none"> <li>• Applicable to many different courses</li> <li>• No class time (unless done in a class) except for a short introduction</li> <li>• Can be used for a very specific topic</li> </ul>	<ul style="list-style-type: none"> <li>• Require some investment from the student</li> <li>• Can be challenging to evaluate</li> <li>• Engineering students often not used to reflect</li> </ul>

## Personal development process

Ways to use the intervention to support the different phases of the students' PDP process:

Identify strengths and weaknesses	<ul style="list-style-type: none"> <li>• Use strengths and weaknesses as a topic of a reflective essay assignment</li> </ul>
Prepare a plan for learning	<ul style="list-style-type: none"> <li>• Ask students to write a reflective essay about their learning goals in the course</li> </ul>
Act by executing the learning plan	<ul style="list-style-type: none"> <li>• If necessary provide practical support for their essay writing</li> </ul>
Monitor the learning process	<ul style="list-style-type: none"> <li>• At the end of a course, ask students to revisit their reflective essay on learning goals and amend it with evaluations of their achievement</li> </ul>
Reflect on the process and what is next	<ul style="list-style-type: none"> <li>• Ask students to reflect upon a specific learning event / task / challenge in a reflective essay</li> </ul>

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# Lecture on LLL and/or PDP

## Description

An oral presentation by the teacher about lifelong learning and/or personal development. Can contain general information about the topics (what do they mean or consist of etc.), specific information about their role in engineering education and/or career, and or practical tips on how to become lifelong learner / develop personally.

Advantages	Challenges
<ul style="list-style-type: none"> <li>• Easy to administer</li> <li>• Can be recorded for later purposes (e.g. to be part of self-study or instruction material)</li> </ul>	<ul style="list-style-type: none"> <li>• Student activation may be difficult</li> <li>• Requires class-time</li> </ul>

## Personal development process

Ways to use the intervention to support the different phases of the students' PDP process:

<b>Identify</b> strengths and weaknesses	<ul style="list-style-type: none"> <li>• Explain the importance of identification for learning and personal development processes</li> <li>• Introduce methods and tools for identification</li> </ul>
<b>Prepare</b> a plan for learning	<ul style="list-style-type: none"> <li>• Explain the importance of preparation for learning and personal development processes</li> <li>• Introduce methods and tools for preparation / planning</li> </ul>
<b>Act</b> by executing the learning plan	<ul style="list-style-type: none"> <li>• Activate students during the lecture with small assignments or tasks</li> </ul>
<b>Monitor</b> the learning process	<ul style="list-style-type: none"> <li>• Explain the importance of monitoring for learning and personal development processes</li> <li>• Introduce methods and tools for monitoring</li> </ul>
<b>Reflect</b> on the process and what is next	<ul style="list-style-type: none"> <li>• Explain the importance of reflection for learning and personal development processes</li> <li>• Introduce methods and tools for reflection</li> </ul>

## Good support for LLL competencies:

- Locating and scrutinizing information
- Self-monitoring
- Creating a learning plan
- Willingness, motivation and curiosity to learn
- Self-reflection

# Online resources on LLL/PDP

## Description

An online compilation of information about lifelong learning and/or personal development. Can contain general information about the topics (what do they mean or consist of etc.), specific information about their role in engineering education and/or career, and or practical tips on how to become lifelong learner / develop personally.

Advantages	Challenges
<ul style="list-style-type: none"> <li>• Light on resources after the start investment</li> <li>• No class time except for a short introduction</li> <li>• Applicable to many different courses</li> <li>• Flexible format for students</li> </ul>	<ul style="list-style-type: none"> <li>• Collecting the resources (start investment) takes time</li> <li>• Requires regular maintenance (checking the links etc.)</li> <li>• No control/view over students' doing</li> </ul>

## Personal development process

Ways to use the intervention to support the different phases of the students' PDP process:

<b>Identify</b> strengths and weaknesses	<ul style="list-style-type: none"> <li>• Provide material on the importance of identification for learning and personal development processes</li> <li>• Introduce methods and tools for identification</li> <li>• Provide online tools for identification</li> </ul>
<b>Prepare</b> a plan for learning	<ul style="list-style-type: none"> <li>• Provide material on the importance of preparation for learning and personal development processes</li> <li>• Introduce methods and tools for preparation / planning</li> <li>• Provide online tools for planning</li> </ul>
<b>Act</b> by executing the learning plan	<ul style="list-style-type: none"> <li>• Provide interactive materials and online tasks</li> <li>• Use online resources as a basis for part of course assessment</li> </ul>
<b>Monitor</b> the learning process	<ul style="list-style-type: none"> <li>• Provide material on the importance of monitoring for learning and personal development processes</li> <li>• Introduce methods and tools for monitoring</li> <li>• Provide online tools for monitoring learning</li> </ul>
<b>Reflect</b> on the process and what is next	<ul style="list-style-type: none"> <li>• Provide material on the importance of reflection for learning and personal development processes</li> <li>• Introduce methods and tools for reflection</li> <li>• Provide online tools for reflection</li> </ul>

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