

EG1000 – Engineering Design and Innovation

Engineering Design Process – Concept Generation

Team Facilitation Guide

Team Facilitation Guide – Conceptual Design

The aim of the Conceptual Design Stage is to generate a wide range of possible solutions to the problem specified in the design brief and revised and restated by your team in EDP – Problem Statement.

Facilitators should be aware of and alert to a tendency among some students to judge solutions rather than generate them. A brainstorming approach means accepting all proposed solutions without judging them at this stage.

Roles

A Team member will take the role of facilitator for the team activities during this phase. This guide is for the facilitator to use during the meeting. The facilitator should still be a participant in the process.

Another team member needs to take the role of scribe, and to prepare minutes of the meeting. It may be best if the facilitator and scribe work as a team. The scribe needs to take minutes of the meeting and have copies of all whiteboard activities. See the guide for preparing meeting minutes.

Choose a different facilitator and scribe from EDP – Problem Statement, so that all Team members are able to take a turn at one of these roles.

Note: all students should have considered the lecture material and Chapter 7 of 'Engineering Design', and have their own proposed solutions. Carry out a quick check to see if the Team members are prepared and ready for the activity. If most members are not prepared is best to consider and agree on what needs to be done and to schedule another meeting.

Step 1 - Review Team Problem Statement and follow-up

Ask the Team members to confirm their understanding of the Team's problem statement and to report on follow-up to the key learning issues identified by the Team in EDP – Problem Statement. Try to ensure that all members have a chance to briefly report. Some clarification questions may be necessary to ensure that Team members understand the reports.

Questions such as:

- What do you mean by ... ?
 - How is that different from ... ?
- may help to clarify any issues.

Step 2 – Morph chart

Consider the attributes and functions that you identified these when developing your problem statement. Then list all the ways that these can be achieved. This will result in a table or chart of function or attribute by means of achieving it. (See Dym 7.1.1).

Check for agreement on whether the diagram captures the important relationships between ideas. Important questions are:

- Is anything missing?
- If so, what may be needed to fill the gap?

The scribe should have a copy of the diagram.

It might be good at this point to decompose your problem into sub-problems and to apply the idea-generating methods that follow to one or more of these sub-problems. The scribe should retain the morph chart.

Step 3 - Brainstorming and generating ideas

Quickly remind Team members of the purpose of this stage, which is to generate many possible solutions. Use the brainstorming technique to start the process. If possible, set up a whiteboard or large sheet of paper, divided into columns, for ideas and themes.

More space will be needed for the ideas column. Ask the team members to present the ideas from their individual preparation, and list these under 'ideas'. More ideas may be generated during this process. These should be encouraged and all ideas listed without any judgement on them.

Ideas	Themes or subsystems

When all ideas have been listed, discuss the themes with the Team. These are aspects or subsystems of the design. Try to find a way of grouping ideas so that they relate to themes or subsystems. A way of doing this is to color code the themes and circle ideas relating to themes with the same color. Some ideas may relate to more than one theme. That's okay and this is a good way of identifying those ideas.

Ask for any further comments after the thematic grouping. Some key questions at this point are:

- Do any aspects seem to be missing?
- If so, what may be needed?
- Are all ideas represented on the board?
- Do the thematic groups represent everybody's understanding?
- Do they suggest anything new?

The scribe needs to note all ideas and themes.

Step 4 – the 6-3-5 method (Dym 7.1.3) – also known as Brainwriting

The team sits around a table. Each member writes down 3 design ideas in brief form. The papers are rotated around the table with each member writing comments or additions to each paper. Then they are spread out and the design ideas discussed. Identify ideas that should be discussed further. Keep the sheets for further reference and note any suggestions for further action.

Step 5 – Sketching (C-sketch method, Dym 7.1.4)

Ask the Team for suggestions for aspects of the design that could be developed further during the meeting, and discuss until the Team can come to agreement on this.

Ask each Team member to draw an annotated sketch of their ideas for that aspect of the design. Allow about 5 minutes for sketching.

Ask the Team members to pass the sketches around the other Team members, so that each person can add to the sketch or the annotations.

Gather all of these together and distribute them randomly to the Team. Ask for comments and discussion on the ideas suggested by the sketches. Keep the sketches for further reference. Note any ideas that Team members feel should be taken further. Try to keep this discussion at the level of identifying ideas rather than discussing their merit.

Step 6- learning issues

Ask Team members to identify issues or matters the Team needs to know more about, to move on to the next stage of the design process. This could, for example, involve research into characteristics of materials or physical principles, or how subsystems or processes may work. Agree on an action plan involving who will follow up on what aspect (and when), so that this can be reported back to the Team at the beginning of the next stage of your project. The scribe should note agreed follow-up tasks in the action column of the meeting minutes.

Assessed Content and Format

Task Description – Group Presentation Week 5

Prepare a 10 – 15 minute presentation (includes 2 minutes for questions) to present as a team to your peers in your week 5 mentoring session, use slides as your team requires. The group presentation will focus mainly on the conceptual design process and include sketches and an explanation of at least one component of the design options.

Your group presentation should include the following:

- Significance of the concept generation stage
- Morph Chart
- Concept generation methods used by the team.
- Sketches and discussion of one component of your team's design

Marking Guideline

Marking for this assessment is weighted 50% by the mentor and 50% by the students of other teams in the mentoring session, taken as the mean of other student's marks. Final marks will be put through a moderation process to ensure fair marking and consistency.

Marking Rubric

Criteria	Non-Attempt (0)	Unsatisfactory (0.3)	Satisfactory (0.65)	Excellent (1)
Demonstrate an understanding into why the concept generation stage is an important aspect of a design project	○	○	○	○
Morph Chart	○	○	○	○
Discussion of concept generation methods used by the group	○	○	○	○
Clearly spoken with authority while maintaining eye contact	○	○	○	○
Overall impression of the presentation	○	○	○	○

Task Description – Individual Task Week 5

Provide a one-page report on a concept or sub system which *you have individually* designed. You should include an annotated sketch and explanation of what parts of the project it aims to meet.

The majority of this page should focus on the concept generation methods used and how it resulted in the design of the provided element.

The task should be submitted using the Concept Generation Submission inbox (available in assessment hub section on MOODLE) by Friday Week 5, 11 pm. Late penalty, 5% per day.

Marking Guideline

This task will be marked individually by the mentor using the marking criteria as shown in the marking rubric. Final marks will be put through a moderation process to ensure fair marking and consistency.

Marking Rubric

Criteria	Non-Attempt (0)	Unsatisfactory (0.3)	Satisfactory (0.65)	Excellent (1)
Demonstrated understanding into why the concept generation stage is an important aspect of a design project	○	○	○	○
Used and identified an appropriate concept generation method	○	○	○	○
Explained how the concept generation method used allowed the student to design the concept element	○	○	○	○
Well drawn sketch with annotations which explain roughly how the concept works and interacts with the rest of the system	○	○	○	○
Overall impression of the report	○	○	○	○