THE VISUAL LITERACY FOR ENGINEERING EDUCATION TOOLKIT

VLEE
VISUAL LITERACY FOR ENGINEERING EDUCATION

25 TOP VISUAL DIGITAL TOOLS FOR ENGINEERING EDUCATION AND WHY YOU SHOULD USE THEM

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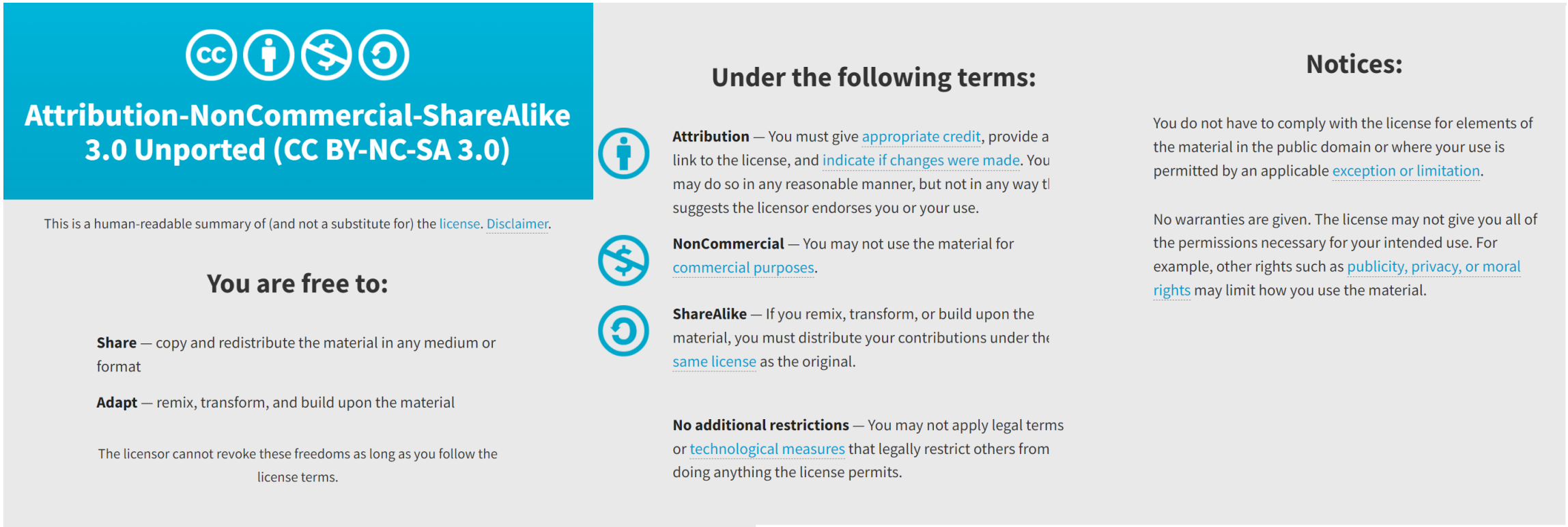

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Toolkit Overview

Visual communication is a process which can help engineers to convey complex ideas more simply.

In recent years digital tools have transformed the process of visual communication.

BUT they are not being widely used in Engineering Education and there is lack of understanding with regard to the importance of visual literacy and thinking in the field of engineering education. This toolkit is a practical resource which seeks to redress this.

TOOLKIT SECTION 1.

LET’S START WITH THE “WHY?”

Why should you be interested in this toolkit? Why is Visual Literacy in Engineering Education important?

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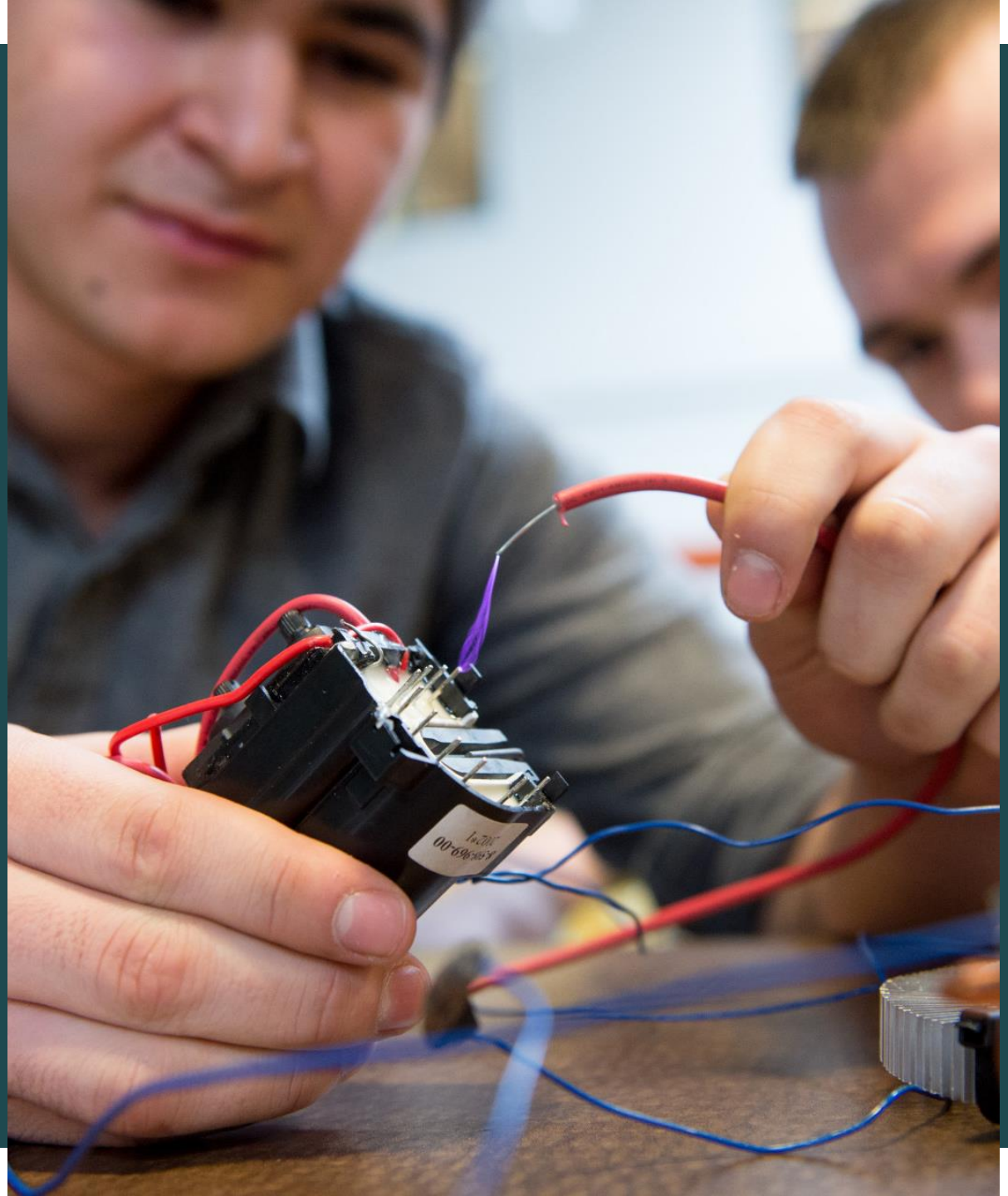
WHO WILL BENEFIT FROM THIS TOOLKIT?

In this Toolkit, we provide practical guidance to engineering educators on incorporating digital design tools into their day-to-day work, ultimately improving the quality and relevance of the education they provide to their engineering graduates.

For the student, the benefits are two-fold; they will increase their visual literacy and digital competencies while also further preparing themselves for entry into the smart digital Industry 4.0 world of work.



Key Terms/Ideas/Concepts

The origin of the word Engineer

The word engineer is derived from the Latin words ingeniare ("to create, generate, contrive, devise") and ingenium ("cleverness").

Key Terms/Ideas/Concepts

What do Engineers do?

Engineers typically develop new technological solutions. During the engineering design process, the responsibilities of the engineer may include defining problems, conducting and narrowing research, analyzing criteria, finding and analyzing solutions, and making decisions. Much of an engineer's time is spent on researching, locating, applying, and transferring information. Some research suggests engineers spend 56% of their time engaged in various information related work with 14% of that being actively searching for information.

Key Terms/Ideas/Concepts

Engineering Disciplines

Most engineers specialize in one or more engineering disciplines. The broader discipline of engineering includes specialized subdisciplines that focus on issues associated with developing specific kinds of products or using specific types of technology. The 10 major branches of engineering are:

Aeronautic and astronautic, Biomedical, Chemical, Civil, Computer science, Electrical, Environmental, Mechanical, Nuclear and Systems

Key Terms/Ideas/Concepts

What is a Visually Literate person?

A Visually Literate person is anyone able to interpret, to think, to learn and to express using images, pictures, graphics or physical objects. He is proficient in understanding a message from an image, to reason with images as well as to express ideas by using a drawing or a physical model.

Source: Visual Literacy for Engineering Education Competence Framework

LEARNING ICON LEGEND

CASE STUDY

Insights into Visual Literacy in practice

ASK THE EDUCATORS

Findings from Poland, Ireland, Denmark and Spain on key project topics

EXPERT INSIGHT

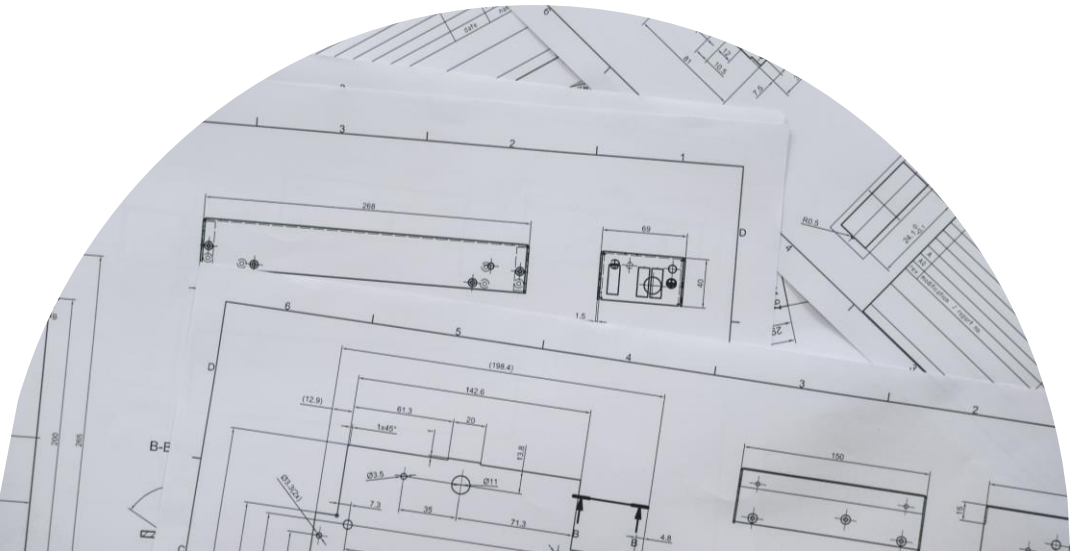
Quotes and thoughts from experts and visionaries

DIGITAL TOOL

Online platform, programme or app for visual literacy in engineering

Keep an eye out for these icons as you move forward through the toolkit…

VISUAL LITERACY HAS HUGE SCOPE IN ENGINEERING EDUCATION



The scope of visual literacy in education now extends beyond illustrative content, symbols, diagrams and charts to encompass drawing and painting, moving images, animations and multimodal media.

With regard to Engineering Education, there are many applications and ways that visual literacy can be used including; mind maps, infographics, technical sketching, 3D imaging, vlogging and video explainers.

In this toolkit we explore 4 key areas where visual literacy comes into play:

- **Engineering Ideation and Visualisation**
- **Research and Planning of Engineering Projects**
- **Preparation of Schematics & Diagrams particularly with regard to Prototyping**
- **Communication, Presentation and Reporting**

VISUAL LITERACY CAN INCITE CREATIVITY AND INNOVATION

It has long been recognized that creativity and innovation are essential qualities of successful engineers. Creativity, as we know, is crucial to helps the generation of new ideas.

Visual thinking activates the side of the brain which is associated with free ideation. This free ideation enables the creation of visual representations and the synthesis of solutions to problems.

Visual expression is a key activity in the process of originating new product ideas in engineering.

Engineering education must be aware of the need teach as well as to practice Visual Literacy being shown to its benefits for ideation and problem-solving skills and innovation competences

WE NEED TO PREPARE ENGINEERING STUDENTS FOR INDUSTRY 4.0

Industry 4.0 refers to the latest industrial revolution, which has seen an acceleration of the digital transformation industrial process via automation technology and intelligent connectivity.

Industry 4.0 powers the quick and effective development and improvement of products throughout their lifecycle.

Industry 4.0 is changing the skill set requirements and competencies of future engineers and technology is evolving at lightning speed.

WE NEED TO PREPARE ENGINEERING STUDENTS FOR INDUSTRY 4.0

The classroom needs to keep up. When students leave their universities, being well-versed in Industry 4.0, capabilities and technologies will lead to greater job prospects and the ability to hit the ground running.

Success in Industry 4.0 begins in the classroom, where students must learn to be prepared for the ever-changing technological challenges they will face upon graduation.

This VLEE Toolkit works to contribute to that aim.

Is visual literacy important in higher and vocational education? Does it warrant discussion or development?

Let’s meet some experts think is it and are breaking the mould with regard to the promotion of visual literacy in engineering, vocational and higher education settings…

CASE STUDY: Visual Thinking and Design at MIT

Source: Visual thinking for engineers | MIT News

Maria Yang, is an Associate Professor of Mechanical Engineering and Engineering Systems and Director of MIT's Ideation Lab has discovered valuable strategies and techniques for designing both consumer products and complex engineering systems, partnering with organisations such as NASA, Ferrari, and IBM.

Her work considers how early-stage design can be effectively utilised during the integration of sub-systems in large-scale projects. The up-front understanding of these techniques can produce significantly better design outcomes, with greater efficiency.

> *My pitch is for visual thinking. Students come to MIT and they are very strong mathematically, but visual thinking is part and parcel of being a mechanical engineer. We need to think about how things fit together, how gears work, how a product works.*
>
> *- Maria Yang*

Based on her studies, Yang encourages her students in 2.00 (Introduction to Design) to sketch and build prototypes early in the design process. This strategy also extends to the design of complex engineering systems.

Watch the video to learn more about Maria Yang and her views on crucial early-stage sketching and prototyping for success.

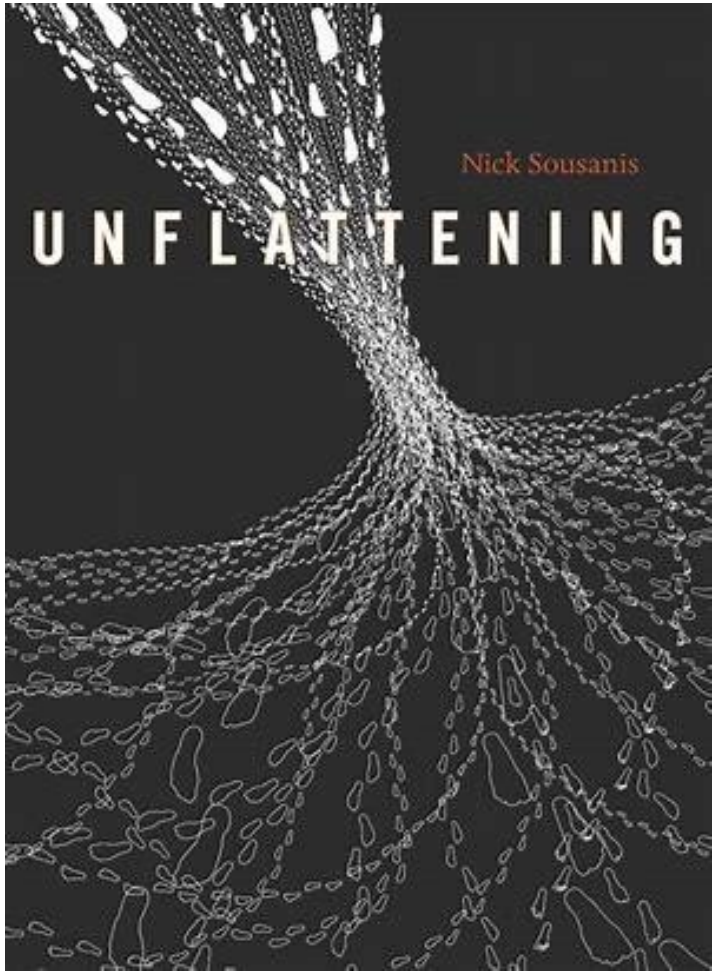
CASE STUDY: The Visual Thesis

A few years ago, Nick Sousanis became the first PhD student at Columbia University to complete a dissertation entirely in comic-book form.

Drawing on his old habit of sketching cartoons, he pitched the idea of a “visual thesis” to the graduate committee, explaining that he could “make complex arguments through that medium that he couldn’t with words alone.”

Not long after completion, an editor at Harvard University Press caught wind of Sousanis’s thesis and asked him to expand it into a book. Sousanis’s editor, Sharmila Sen, says “One of the book’s goals is to challenge the notion that serious ideas require words.”

Sources: Why Visual Literacy Is More Important Than Ever (opencolleges.edu.au)
Drawing Power | SF State Magazine (sfsu.edu)
Unflattening — Nick Sousanis | Harvard University Press



Written and drawn entirely as comics, *Unflattening* is an experiment in visual thinking and learning…

ASK THE EDUCATORS

We’ve been asking if visual thinking is being taken into account in engineering education?

Let’s take a look at some replies from educators and exports in the sector

We have deliberately returned to some basic instruction on sketching and visualization in our first engineering course (statics and mechanics and materials in our program). We include lessons on sketching techniques (including orthographic projection and isometric views) and the role of drawings and models to communicate design. We are hopeful that we will see improvements in our students visualization skills as they progress through our program.

Source: Is visual thinking taken into account in engineering education? (researchgate.net)

Visual thinking is required in all aspect of engineering design. If an engineer wants to design an object even on a sketch sheet, he/she would first have to develop a mind map/pattern which is then translated onto a sheet .

Source: Is visual thinking taken into account in engineering education? (researchgate.net)

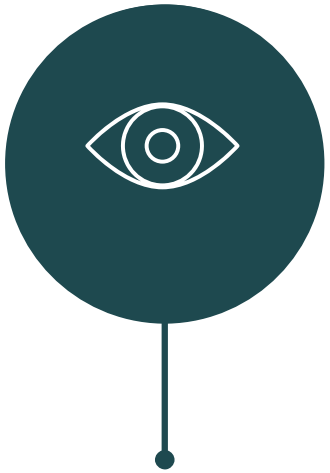
I have taught problem solving and tell the students that expressing a problem visually on paper is often a very helpful step.

Source: Is visual thinking taken into account in engineering education? (researchgate.net)

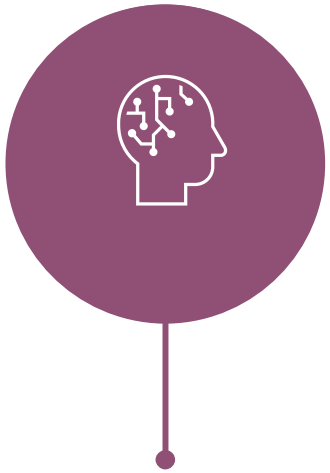
In Introduction to Industrial Arts, we first had to learn to draw objects, both 3-D and exploded diagrams, before we could make them.

Source: Is visual thinking taken into account in engineering education? (researchgate.net)

KEY REASONS "WHY?" YOU SHOULD READ ON



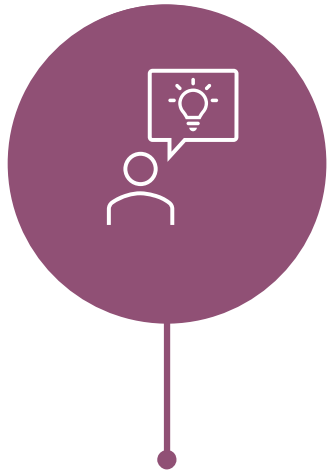
There is no denying that Visual Literacy has a key role to play in Engineering Education



Visual Literacy is an important skill for the next generation of engineers – your students

Engineers need new skills and approaches continuously to help them innovate and solve complex problems

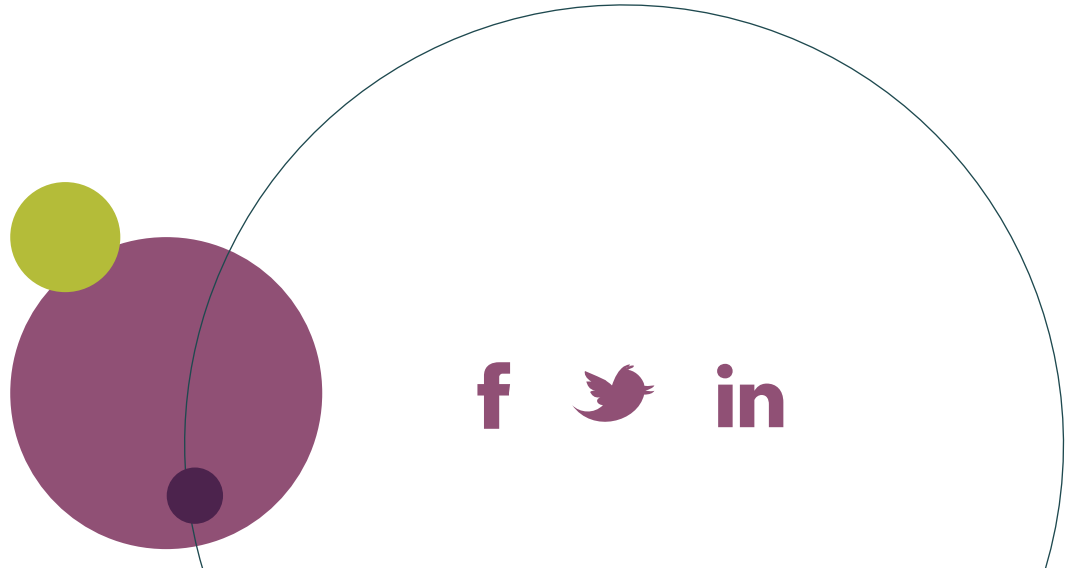
You have seen some of the successes Engineering Educators are having in this area



Visual Literacy has huge scope in Engineering Education. The 20 practical tools herein have been referred by expert Engineering Educators and are tried/tested.

Next up...

Section 2 - Digital/Visual Tools for Ideation and Visualisation



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