Systems Engineering Education, Research, and Introduction in Organization

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Abstract

Many organizations struggle with systems development. Systems Engineering is a profession that claims to help in developing systems. Unfortunately, organizations and managers do not know what systems engineeting is, and what value it may bring. In this presentation, we discuss the education and reserarch in systems engineering, and how to introduce it in organizations.

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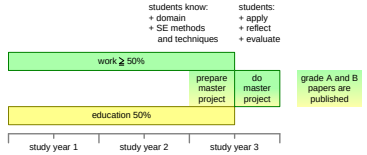
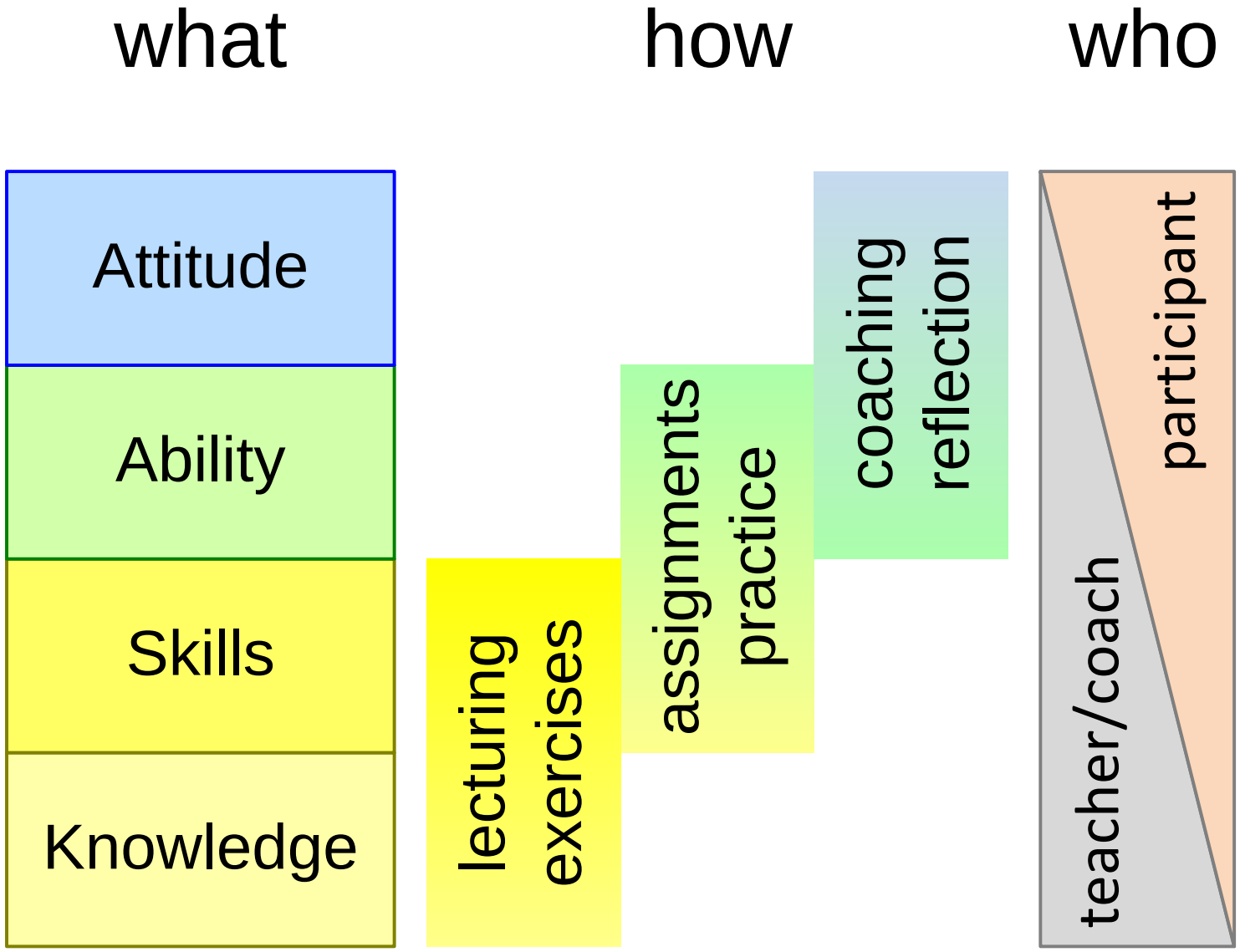
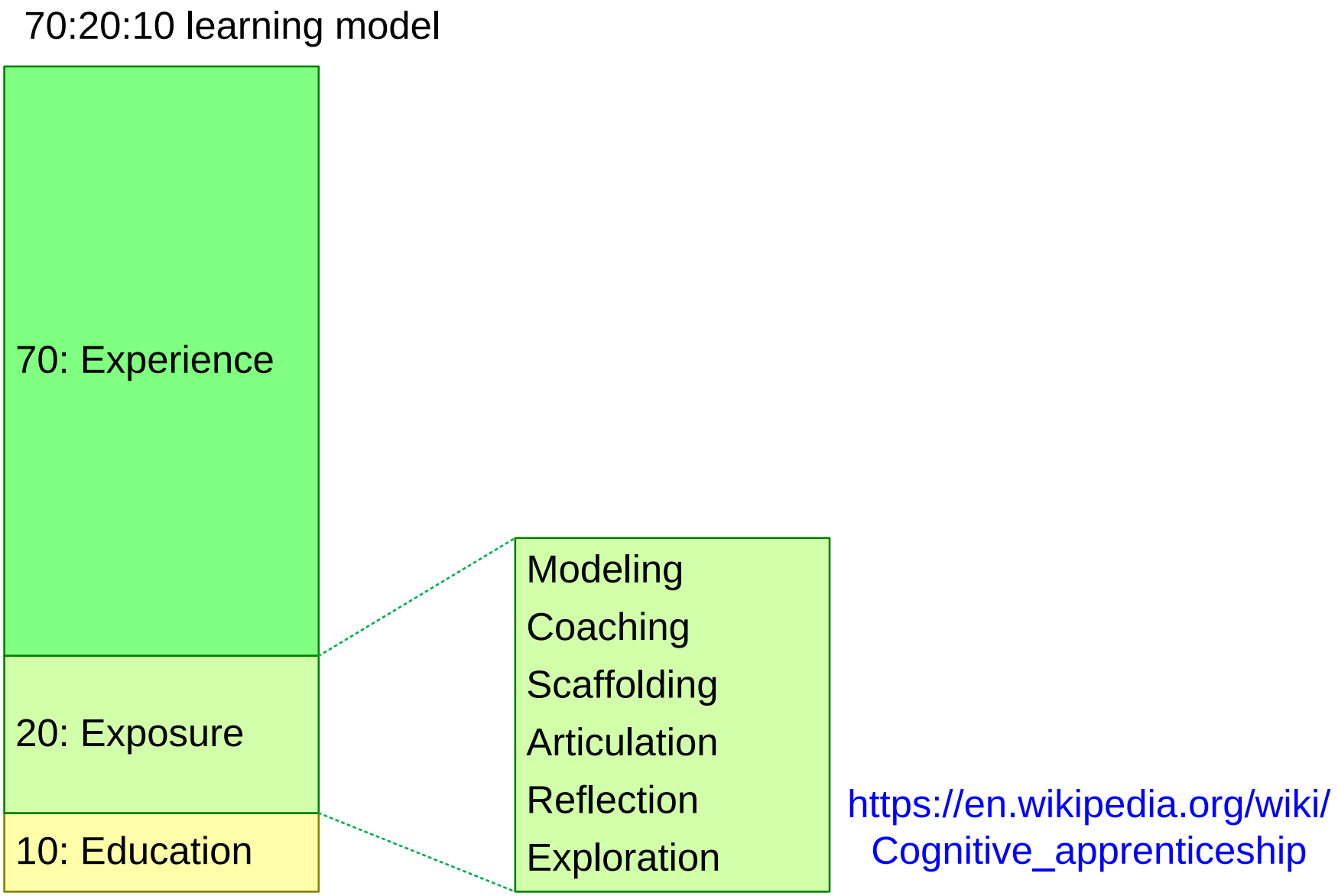


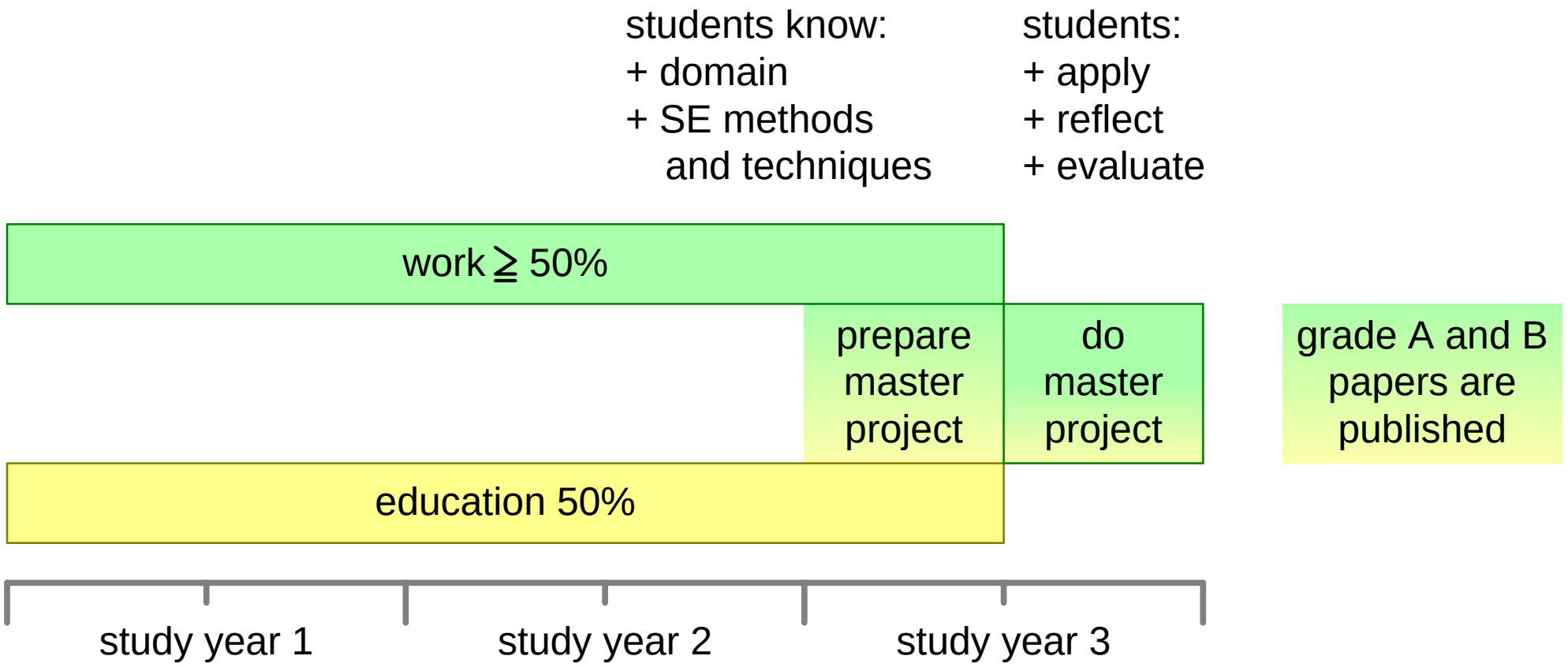
SE Education is Mostly Ability and Attitude



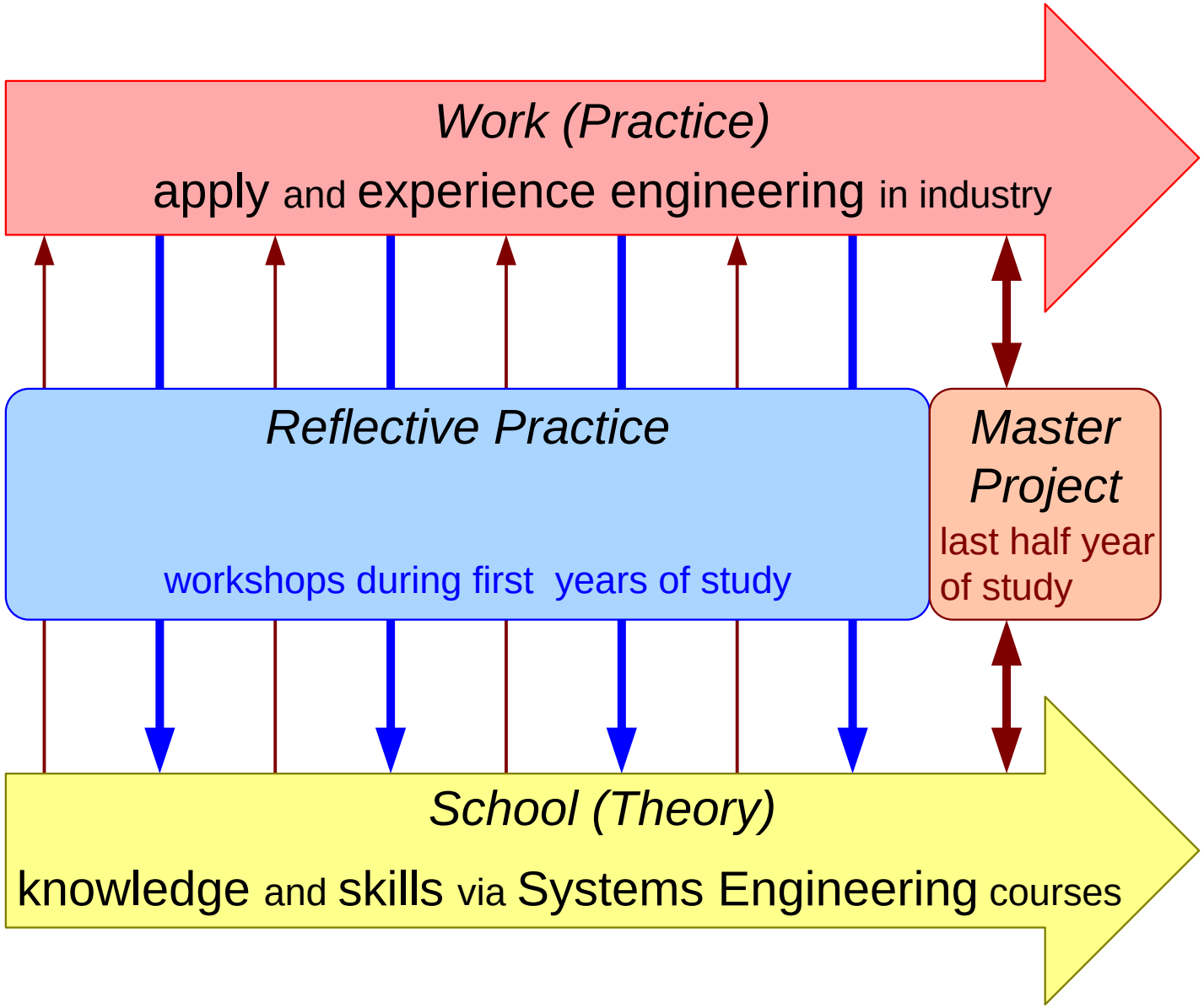
People learn Systems Engineering in Practice



Industry Master Study Model in Konsberg



Reflective Practice



9 Workshops in 3 Years

1st year	Reflection My Role and Style Critical Thinking Domain knowledge
2nd year	How to apply SE in my daily work? Cultural differences (international semester) project (international semester)
3rd year	Communication From Student to Systems Engineer Academic Writing

Survey of “How to Apply SE” 2009..2014

Company and student data
Anonymized
Student distribution 2009..2014

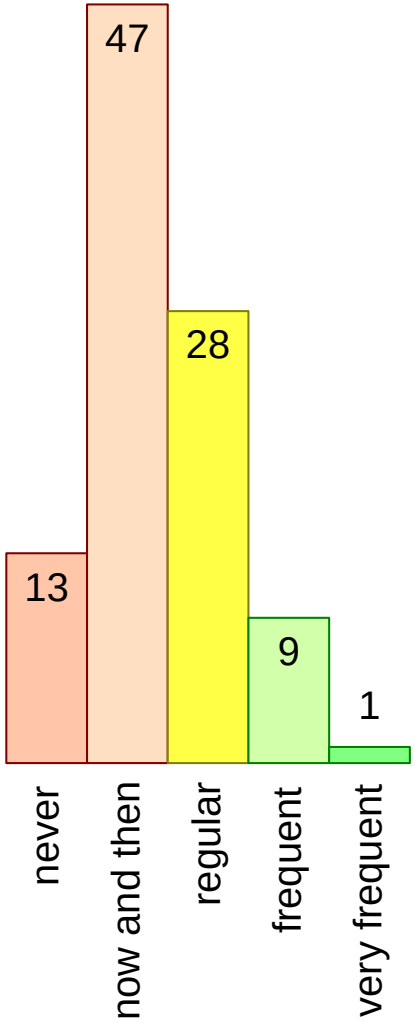
Student distribution over the years

2009	9
2010	12
2011	21
2012	27
2013	18
2014	20
total	107

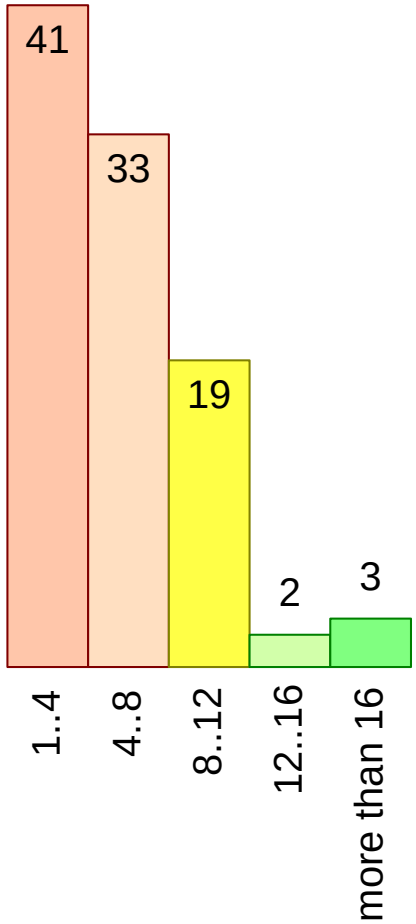
c01	27
c02	21
c03	10
c04	1
c05	13
c06	2
c07	8
c08	2
c09	9
c10	4
c11	1
c12	1
c13	0
c14	5
c15	1
c16	1
changed	1
total	107

Student Response on their Ability to Apply SE

How often can you use SE methods and techniques in your daily work?



How many different SE techniques and methods can you use?



What Students Apply

- project management tools such as GANTT charts
- requirements tracing
- the concept of the V-model
- testing
- some mention systems thinking (the holistic approach)

- **However,**
- many feel that they can barely apply systems engineering in their daily work

Limiting Personal Factors

Mindset and experience of the company and colleagues

- Complex to map on own working situation
- Methods and techniques are not applicable on my work
- Limitations of my own competence and experience
- The need to acquire domain knowledge first
- Own lack of awareness
- Systems engineering perceived to be time consuming
- Working “too low” in the system, e.g. engineering mono-disciplinary components
- Working in a late phase of a project

Limiting External Factors

Mindset and experience of the company and colleagues

- Lack of systems engineering knowledge in the company and colleagues
- Difficult to change the way it always has been done.
- No pull from the company
- Systems engineering perceived to be time consuming
- Strict deadlines, amount of work, and pressure
- Project management focus

Mismatch Perceived and Actual Need

Organizations and Managers ask for:

- requirements management
- work break down structures
- interface management

Organizations **need**:

- the ability to **understand**, **communicate**, and **reason** about:
  - (emerging) **dynamic behavior**
  - (emerging) **qualities** (e.g. performance)
  - at many **levels of abstraction**
- to **make decisions**
  - that result in **Fitness for Purpose**

Recommendations

Create awareness ⟶ managers, leaders, colleagues

by showing value ⟶ concrete (simple) examples

not by “preaching” (“We have to use SE …”)

The good news:

there are plenty of opportunities show value.

The bad news:

showing value during systems integration is most easy.