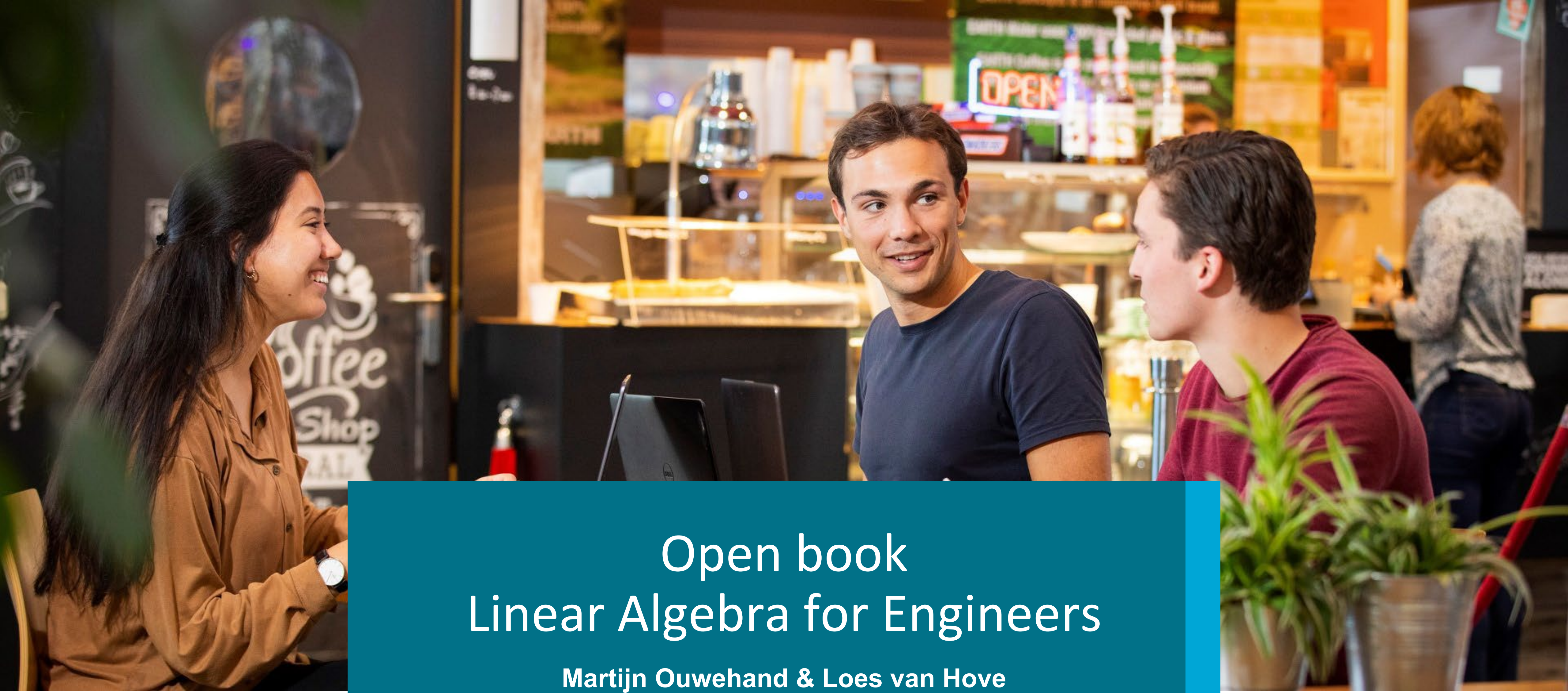

Open book
Linear Algebra for Engineers

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The team

Grasple student

Review students

Visuals Team - PRIME

TU Delft Library

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After this session

- You have discussed what challenges come with writing an open book and how to tackle them

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Program

5' - Check-in

5' - 10' About our project

10' x 3 Challenges

5' Check-out + Questions

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Check-in:

Your name +
Why are you here? +
Something specific you would like to get out of this session? +

How experienced are you? (scale 1-5)

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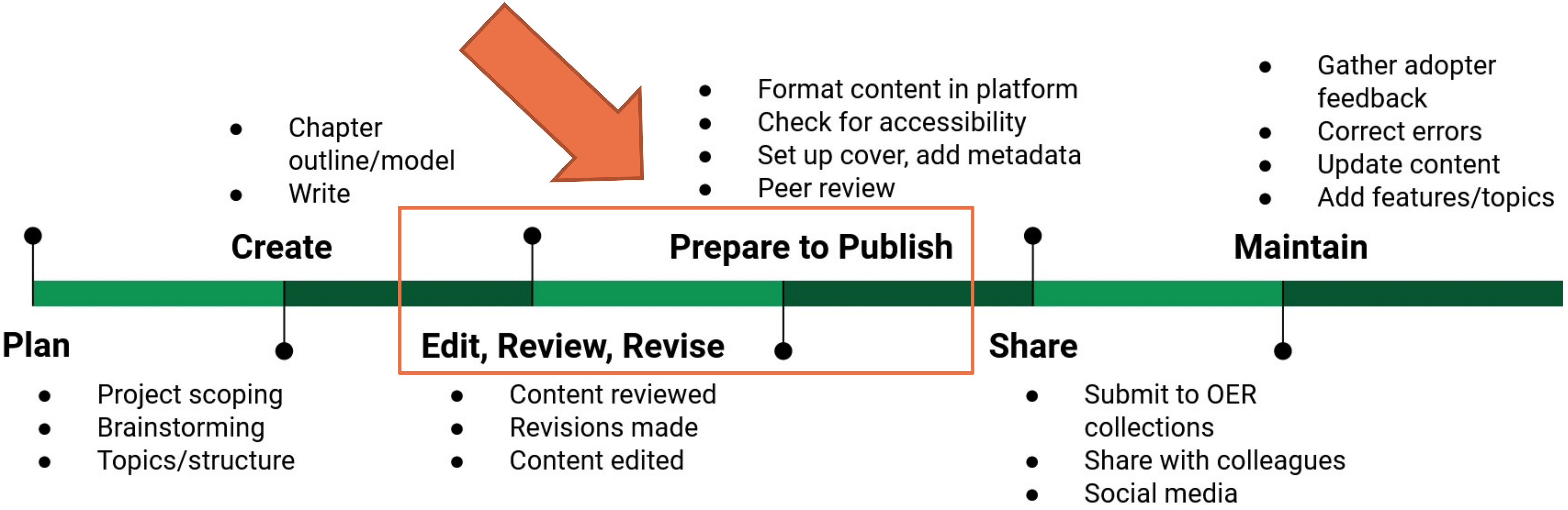
Publication process



Timeline of our project

Kick off
- How to begin?
- How to work together (in Covid Times)?
- How to write a book?

Writing/Reviewing
- Structuring the book
- Making time to write
- How to review?
- Student reviews
- How to organize?
- Finding the time

Grasple
- Identifying and creating exercises
- Integrating Grasple in the book

Platform
- Big group of writers
- Interactivity
- Grasple integration
- LateX

Pilot
- What do students think?
- Does it work?
- How to interweve in learning activities?

Finishing and sharing the book
- Keep writing
- sharing
- processing reviews/feedback

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Timeline of our project

- How to be
- How to wo
  Covid Tim
- How to wr

ng

the

e

Platform

- Big group of writers
- Interactivity
- Grasple integration
- LateX

Pilot

- What do students think?
- Does it work?
- How to interweve in learning activities?

Finishing and sharing the book

- Keep writing
- sharing
- processing reviews/feedback

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https://www.versnellingsplan.nl/Kennisbank/open-tekst-boek/

Question:
Do we need a printed version of the open, online book we create?

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Do we need a printed version of the open, online book we create?

Yes

No

What we learned:

● YES

First we were unsure

Open Education
As accessible and
inclusive as possible

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Challenge:
Tone of voice

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Professional translator: Adjust all chapters to the same language

Every Chapter its own tone of voice

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Outcome:

Each paragraph will have their own tone of voice

How to create cohesion?

- Lay-out
- Structure
- Notation
- Images
- Mathematical language (ie injectivity + surjectivity instead of one-to-one + onto)

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Challenge:

Creating an open book vs adopting a commercial book

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Challenge:
WHY DIY? Why not a commercial book?

- **Form groups:** 3-4 per group
- **Discuss** pro’s and cons of DIY vs commercial solutions
- **Write** pro’s and cons on flipover
- **Discuss** plenary

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Our considerations

- Tailored approach
- Flexibillity
  - For reader
  - For faculties (1 book to rule them all)
  - For teaching staff to mix & match content and integrate content from external resources
- Keeping up to date and connected to TU Delft programmes and initiatives (i.e. MOOCs) – one body of knowledge
- Integration with tools to practice already used on campus (integral/seemless learning experience)
- Open for reuse by others
- Open to feedback from others
- Cost reductions for students (after investment)

Other challenges

Finding a suitable platform (LaTeX-friendly) → LibreTexts

Interactive exercises → Grasple

Finding TIME

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3 - Orthogonality

In $\mathbb{R}^2$ and $\mathbb{R}^3$ the dot product gives an easy way to check whether two vectors are perpendicular:

$$\mathbf{v} \perp \mathbf{w} \iff \mathbf{v} \cdot \mathbf{w} = 0.$$

We use this identity to define the concept of perpendicularity in $\mathbb{R}^n$. It seems a bit `academic', but in this more general setting the te

Definition 6

Two vectors $\mathbf{v}$ and $\mathbf{w}$ in $\mathbb{R}^n$ are called *orthogonal* if $\mathbf{v} \cdot \mathbf{w} = 0$. As before, we denote this by $\mathbf{v} \perp \mathbf{w}$.

Example 7

Let $\mathbf{u} = \begin{bmatrix} 1 \\ 2 \\ -1 \\ -1 \end{bmatrix}$, $\mathbf{v} = \begin{bmatrix} 3 \\ -1 \\ 2 \\ -1 \end{bmatrix}$, $\mathbf{w} = \begin{bmatrix} 2 \\ 2 \\ -1 \\ 2 \end{bmatrix}$. We compute

$$\mathbf{u} \cdot \mathbf{v} = 3 - 2 - 2 + 1 = 0,$$

$$\mathbf{u} \cdot \mathbf{w} = 2 + 4 + 1 - 2 = 5,$$

$$\mathbf{v} \cdot \mathbf{w} = 6 - 2 - 2 - 2 = 0,$$

and conclude: $\mathbf{u}$ and $\mathbf{v}$ are orthogonal, $\mathbf{u}$ and $\mathbf{w}$ are not orthogonal, $\mathbf{v}$ and $\mathbf{w}$ are orthogonal. In $\mathbb{R}^2$, two nonzero vectors that are orthogonal to automatically multiples of each other (i.e. have either the same or the opposite direction). In $\mathbb{R}^n$ with $n \geq 3$ this no longer holds. In this example vector $\mathbf{w}$ are orthogonal to the vector $\mathbf{c}$, but $\mathbf{u} \neq c\mathbf{w}$.

By definition the zero vector is orthogonal to any vector, since $\mathbf{0} \cdot \mathbf{v} = 0$. Moreover, the zero vector is the *only* vector that is orthogona

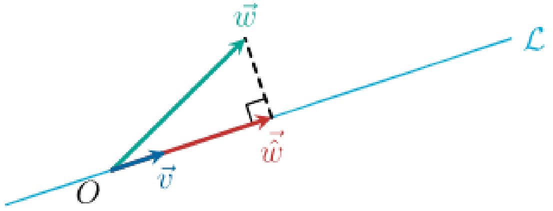

Figure 6. Projection of a vector $\mathbf{w}$ onto a non-zero vector $\mathbf{v}$

Proposition 11

In the definition above the vector $\hat{\mathbf{w}}$ with these properties is unique and it is given by

$$\text{proj}_{\mathbf{v}}(\mathbf{w}) = \hat{\mathbf{w}} = \frac{\mathbf{w} \cdot \mathbf{v}}{\mathbf{v} \cdot \mathbf{v}}\mathbf{v}$$

Skip/Read the proof

Proof

With the rules of the dot product the vector $\mathbf{w}$ is easily constructed: Starting from

$$\hat{\mathbf{w}} = t\mathbf{v}, \text{ for some } t \in \mathbb{R}$$

and

$$(\mathbf{w} - \hat{\mathbf{w}}) \perp \mathbf{v}$$

it follows that we must have

$$(\mathbf{w} - t\mathbf{v}) \cdot \mathbf{v} = \mathbf{w} \cdot \mathbf{v} - t(\mathbf{v} \cdot \mathbf{v}) = 0$$

What did you take away from this session?

Questions?

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