Human-centered innovation in water resources management education: A co-creation approach to developing VR learning experiences

Stella Kanatouri, Heribert Nacken, Sina Truckenbrodt & Friederike Klan

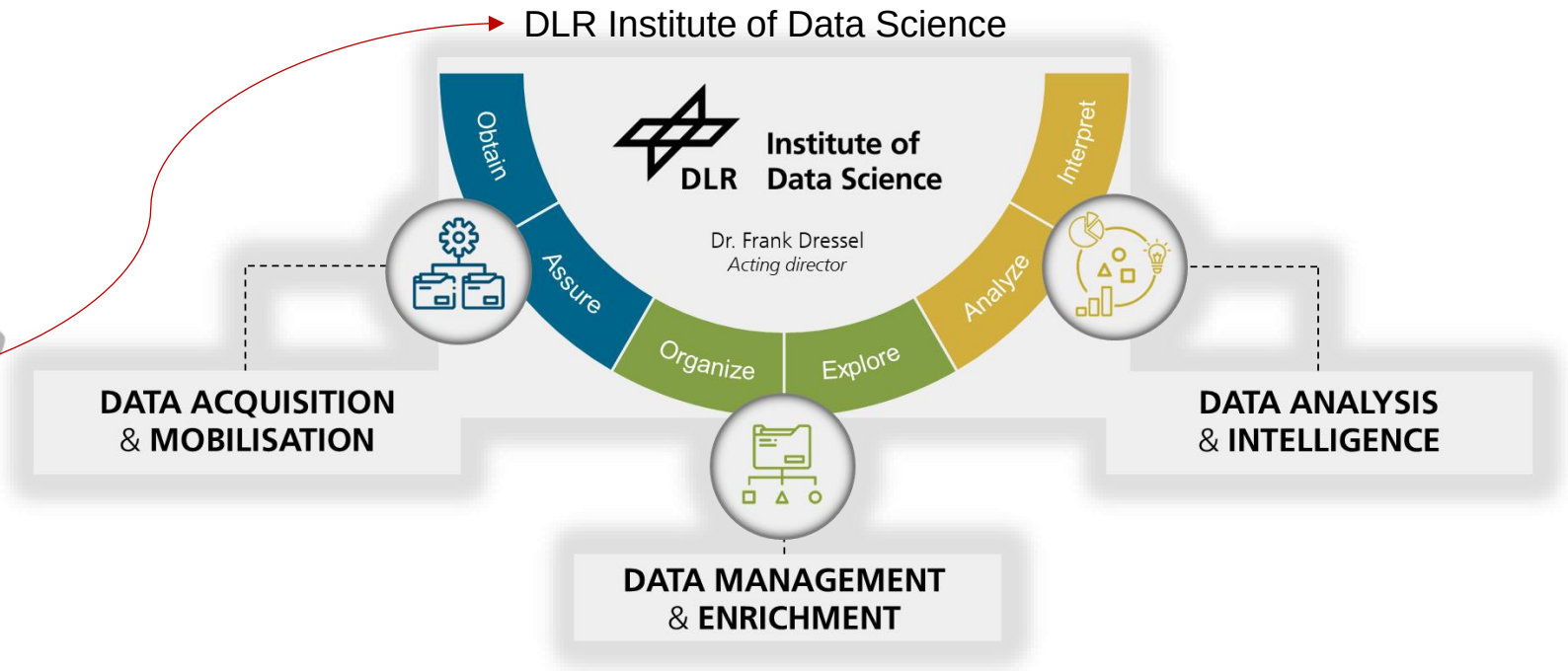
Contact:

German Aerospace Center (DLR) - Institute of Data Science, Jena

stella.kanatouri@dlr.de

Stella Kanatouri

- Past: Qualitative research in academia and industry.
- Current position: Researcher in German Aerospace Center (DLR), Institute of Data Science.



- The German Aerospace Center (DLR) is the research and technology center of the Federal Republic of Germany for aeronautics and space as well as energy, transport, security and defence.

WaterLab Project

Development of a Virtual Reality learning environment about Water Resources Management

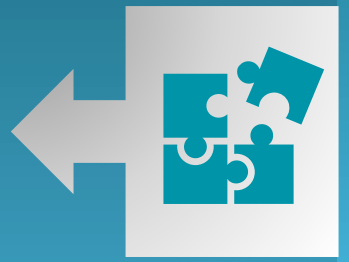
German Aerospace Center (DLR), WaterLab Project.
Source: https://www.dlr.de/en/dw/research-transfer/projects/current-projects
Credit: DLR

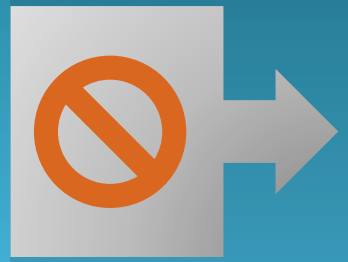
A. Scholl (2024) Zentrum für Digitale Transformation Thüringen (ZeTT)
Credit: Zentrum Digitale Transformation Thüringen – ZeTT

Virtual Reality in Education

POTENTIAL
(according to Vats & Joshi (2023) and Kumar & Gorai (2025))

- Hands-on
- Engaging
- Memorable
- Positive learning outcomes





BARRIERS
(according to Vats & Joshi (2023) and Samala et al. (2025))

- Off-the shelf VR apps:
  No direct match to curriculum
- Bespoke VR apps:
  Time & cost-intensive development

  Low scalability

How might Human-Centered VR development help?

Relevant educational contents

Aligned with learning needs

Curriculum fit

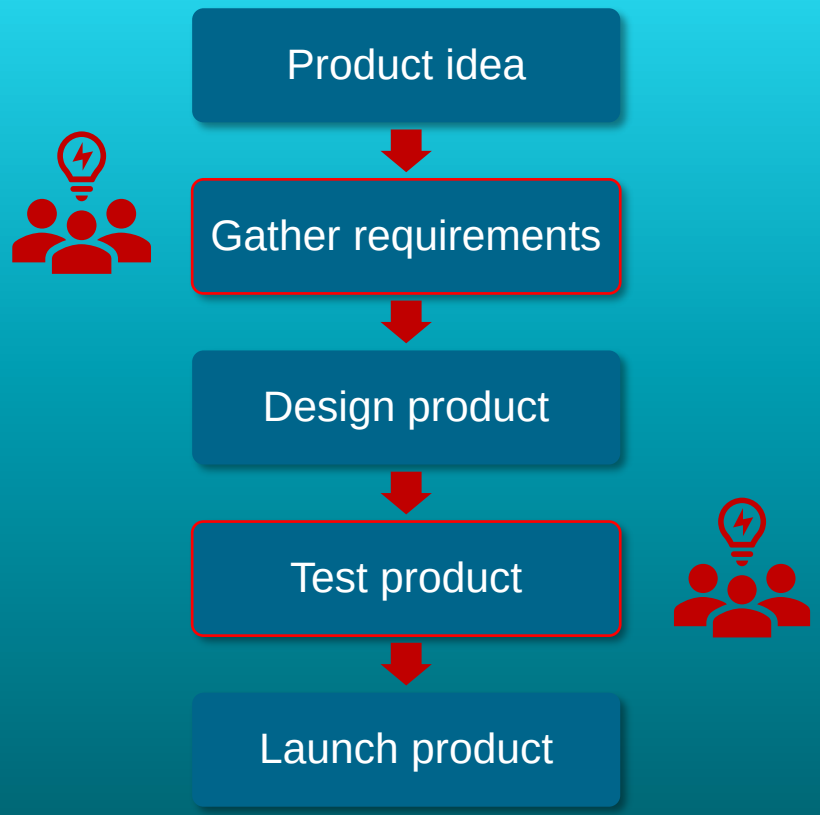
Streamlined development process

User experience

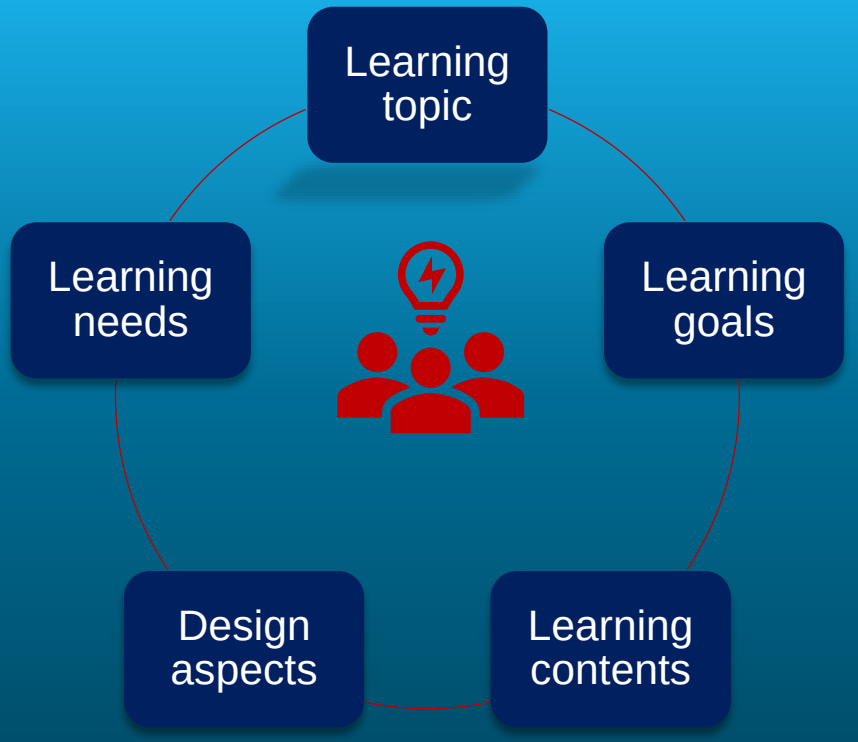
How can end-users contribute more meaningfully to the design of the VR learning experience?

End-users as informants

(according to Livari & Livari (2011), Omerkhel, Yusop, Ismail & Azmi (2023), and Persson (2017))



End-users as co-designers



Thematic focus and design challenge

What should a VR scenario look like for students to acquire the specialist knowledge and skills they need to plan a seawater desalination plant?

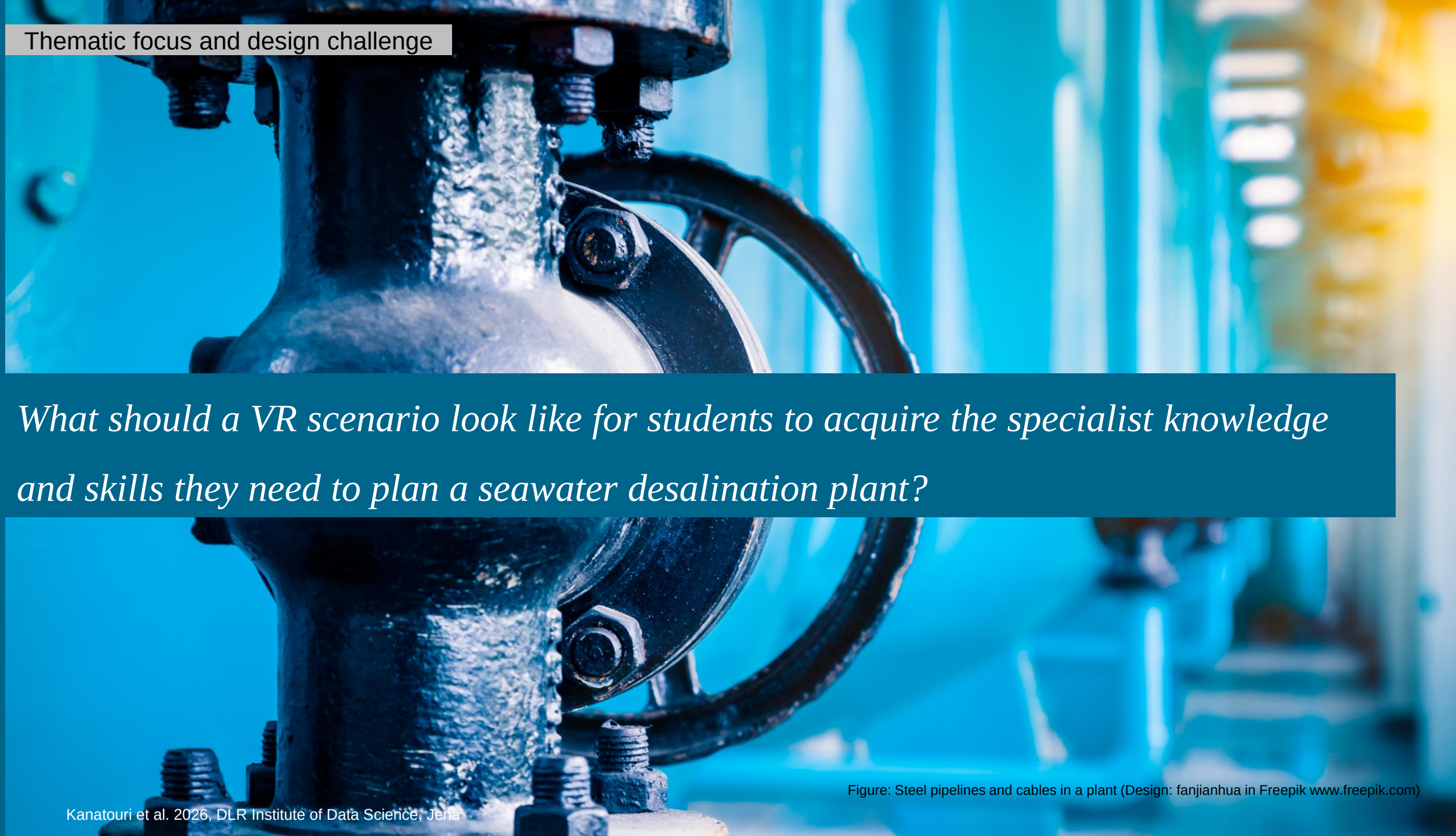


Figure: Steel pipelines and cables in a plant (Design: fanjianhua in Freepik www.freepik.com)

A „wicked problem“ – many possible design solutions

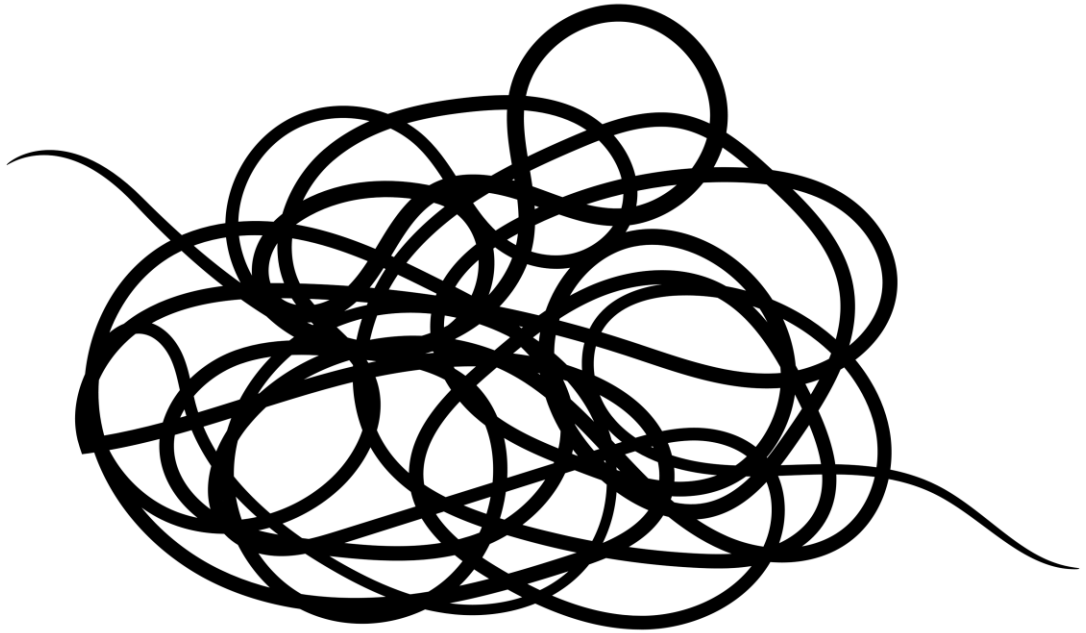


Figure: Doodle tangled scribble (Design: juicyfish in Freepik www.freepik.com)

Design thinking – 5-stage process

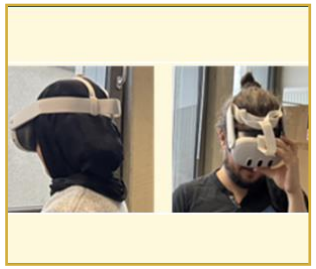
According to the Design Thinking Model by Hasso-Plattner Institute, Institute of Design at Stanford.
Figure: Papercut style infinity loop symbol design (Design: Starline)

Design thinking process adapted to 6 phases

Empathize

Pain points & needs

Empower



Familiarize with VR

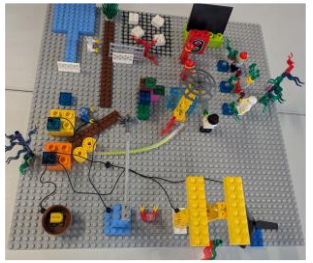
Define

Map knowledge & define design challenge

Ideate

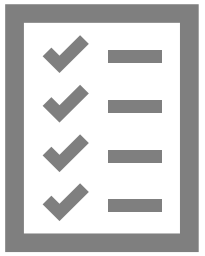
Brainstorm ideas

Prototype



Learning scenario

Test



Test & refine

Interviews

3 Professors (3 universities)
17 Students (6 universities)

Co-creation workshop

Pending

(05 & 10/ 2026)

Figures: Phases of the design thinking process adapted to the WaterLab use case (Photos: © H. Nacken. All rights reserved).

Co-creation workshop to design a VR learning scenario about seawater desalination

WHAT?

- 2-day design thinking workshop

WHO?

- 8 MSc students
- 2 faculty members
- 3 VR developers

WHY?

- VR scenario design and prototyping

Layered prototyping – from analogue to VR

User stories

Fig. A

- 2D analogue, familiar medium
- Individual reflection

Elaborate on initial ideas
Develop first concepts

LEGO® storyboarding

Fig. B

- 3D analogue
- Storytelling & symbolic meaning
- Individual & group prototypes

More tangible prototypes
Detailed 3D storyboard

Rapid VR prototyping

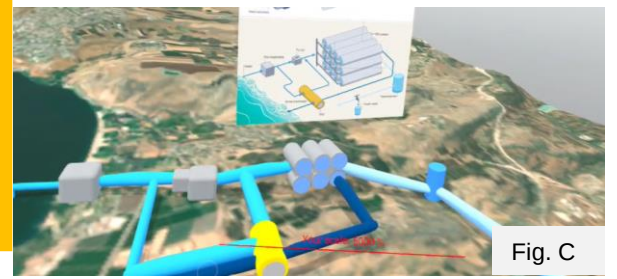


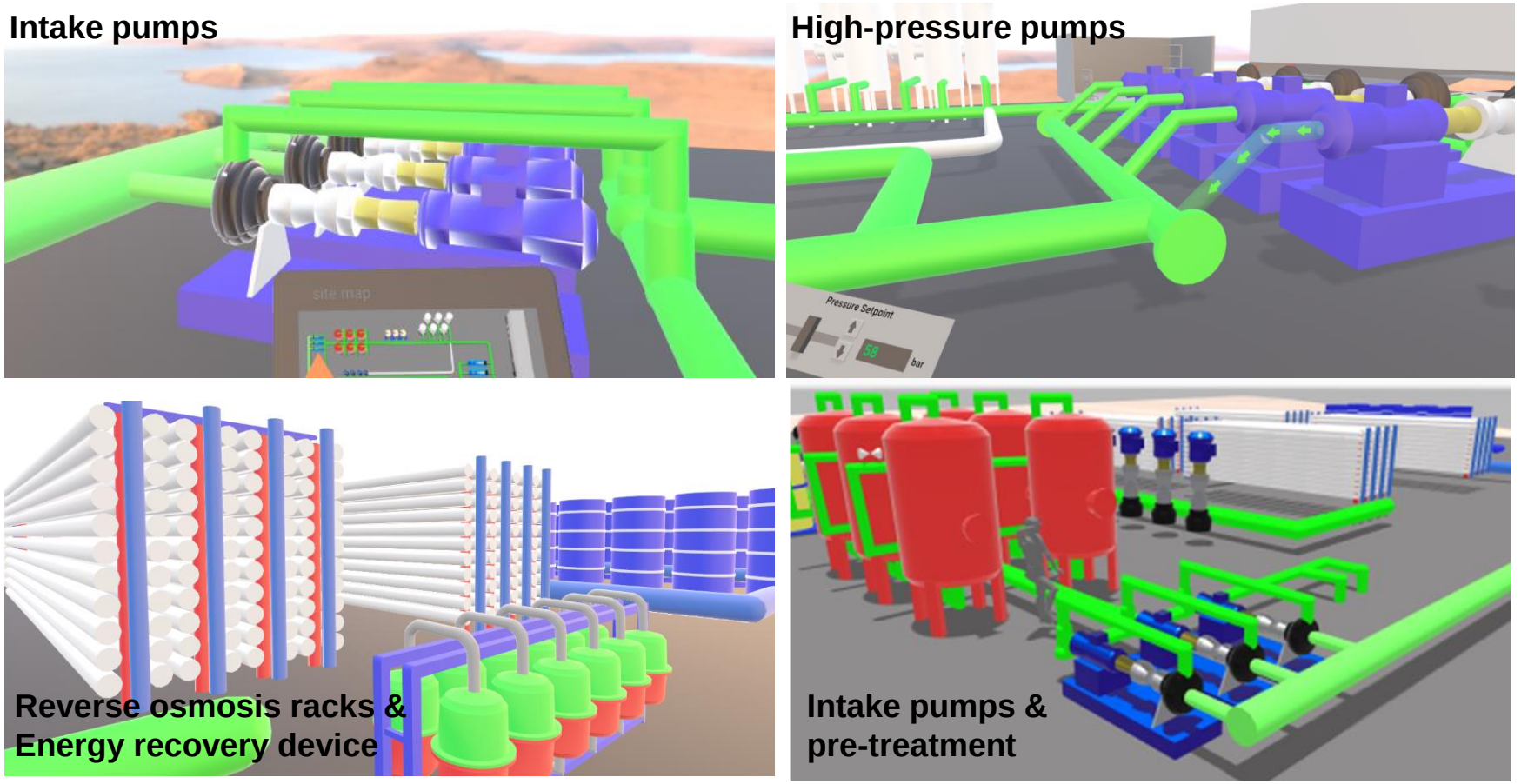
Fig. C

- Rapid VR prototyping using Shapes XR

First VR prototypes

Figures A, B, C: Impressions of the co-creation workshop 01/2025 at RWTH Aachen, Institute of Hydrology (Photos: © H. Nacken. All rights reserved).

Optimization of Reverse Osmosis pressure and efficiency – Shapes XR mock-up



- Tour of the seawater desalination plant
- Experience effects of different pressure levels on water production and energy efficiency

Figures: Screenshots of the Shapes XR prototype showing components of the virtual seawater desalination plant (Design: S. Kanatouri)

No-code development & AI-assistance

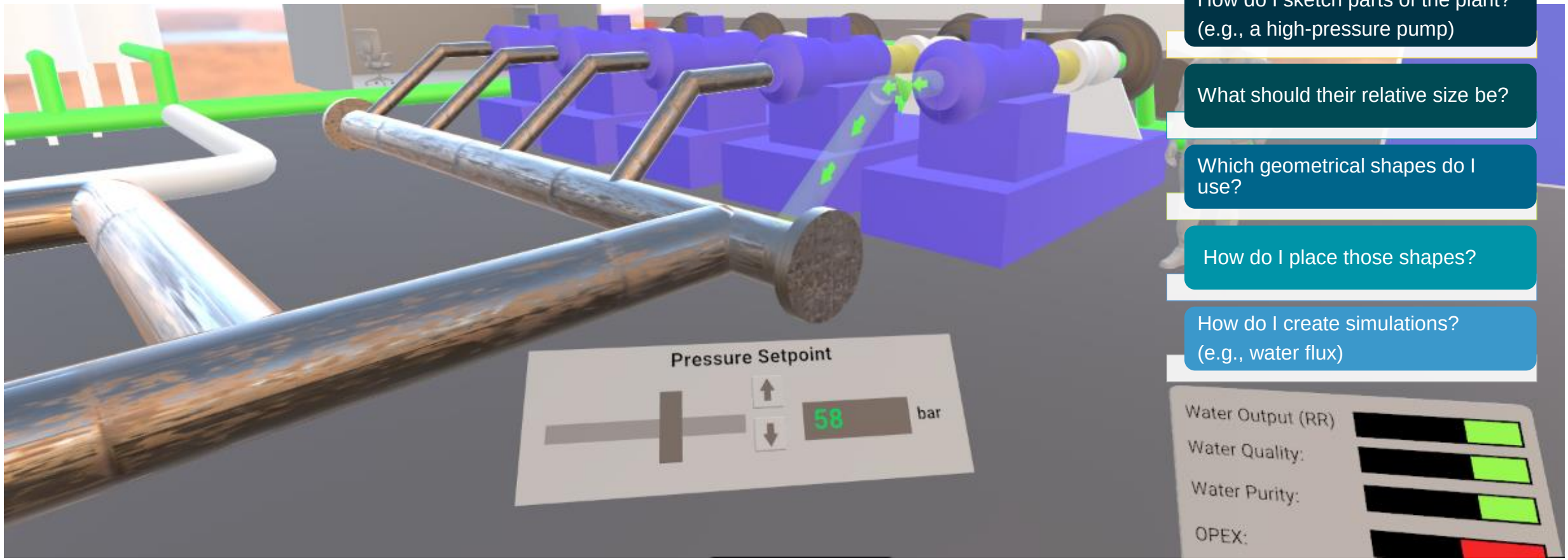
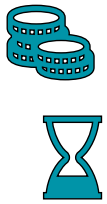


Figure: Screenshot of the Shapes XR prototype showing high-pressure pumps and medium water flux, according to the step-by-step instructions given by Microsoft CoPilot. (Design: S. Kanatouri)

Lessons learned

1 Rapid VR prototyping offers potential to streamline development

- Pre-production workflow before investing in development
- Production begins only once prototype is refined to match needs and user experience



2 No-code development & AI-assistance can make VR content creation accessible to all

- No-coding expertise needed to create simple VR prototypes
- Generative AI can guide the prototyping process (from asset creation to world building)
- Educational institutions could prototype their own VR learning experiences

3 End-user involvement in the entire VR design process is enabled by accessible, no-code tools

- From gathering product requirements, co-creating learning contents, to designing the VR experience

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