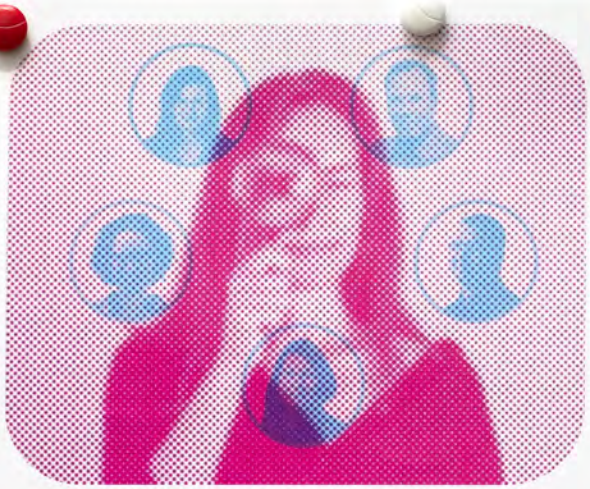


# About the SUTQ

## Are you ready to elevate your teaching skills and make a lasting impact on your students?

## Trajectory Overview

During the trajectory we offer several activities to support you in your journey:

- **Your Own Project**: Choose a project aligned with your teaching goals, such as integrating new technologies, enhancing student well-being, or refining assessment methods.
- **Workshops and Collaboration**: Attend expert-led sessions and connect with fellow educators to exchange experiences and ideas.
- **Guidance and Support**: Receive personalized mentorship and coaching to help you succeed.
- **Portfolio and Assessment**: Showcase your project outcomes and reflections in a portfolio, assessed through an interview to confirm you meet SUTQ standards.

## Who can apply?

Experienced UT teaching staff who:

- have completed the **UTQ** (or equivalent);
- who are **motivated to invest time** (approx. 200h over 1-1,5 years) in their educational and professional development;
- and have the **support** of their programme director and heads of department

Before starting the trajectory, we conduct an intake to ensure suitability, feasibility and aligning of expectations.

## Objectives

After the SUTQ trajectory, you:

- Will have cultivated a **critical and reflective mindset** towards educational practices, enabling you to engage in deeper inquiry and drive continuous improvements in your own teaching as well as within your academic community.
- Will be able to **enhance** your educational practices through an **evidence-informed approach**. This encompasses (a) systematically analysing educational challenges and their causes, (b) designing and implementing targeted interventions, (c) evaluating the effects of the interventions using valid and reliable methods, and (d) critically reflecting on the outcomes as opportunities to "feed-forward".
- Will have made **significant progress** in becoming a **Scholarly Teacher**, as described by Ruth Graham.

## More information

SUTQ WEBSITE

SUTQ MAGAZINE

**If you have any questions, or to sign up for the mailing list for upcoming runs, email Sonja Borst (s.borst@utwente.nl)**

**NEXT RUN IS TO START IN FEBRUARY**

More information will f w after summer

# Active and Connected Blended Learning

## Benefits of Blended Learning

**1. Efficiency**
Time gains for teachers after initial investment

**2. Scalability**
Reach more students via online components

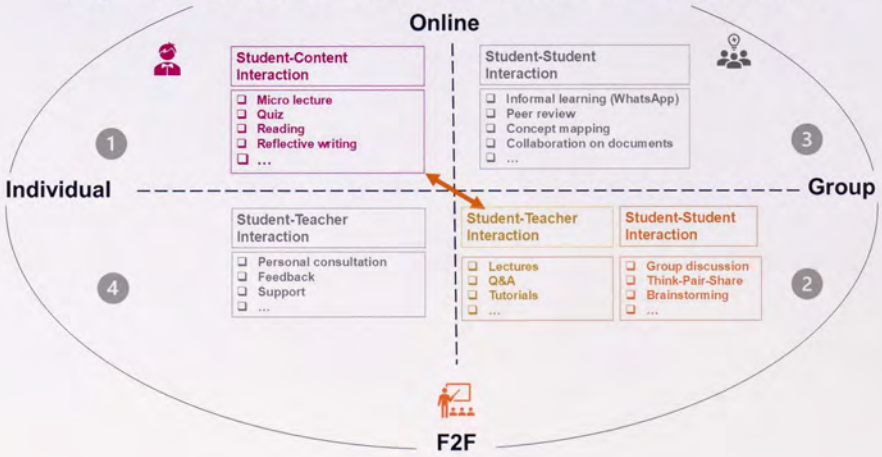
**3. Flexibility**
Offer diverse learning options

**4. Engagement**
Foster deeper engagement and active participation

## Enhance Your Course With Blended Learning

Working together on a concrete project of your choice, we help you apply research- based best practices to enhance your course. Our design aims at **activating** mental processes conducive to learning while **connecting** students to form a strong sense of community.

## ACTIVE & CONNECTED BLENDED LEARNING




Pei, L., Poortman, C., Schildkamp, K., & Benes, N. (2025). Professional development for promoting a sense of community in blended learning. *Professional Development in Education*, 1-19.

## How We Can Help

**Personalised approach**
Adapted to on your ideas and needs

**Hands-on support from beginning to end**
From design to implementation

**Research- based best practices**
Community of inquiry framework

## Contact US

Linlin Pei, Francesca Frittella, Diane Zievinger
Centre of Expertise in Learning & Teaching (CELT)

UNIVERSITY OF TWENTE.

# SUTQ Project update on:
# Enhancing Critical Thinking and Responsible Use of AI/LLMs

## Integrating Rebuttal Assignments into the project plan of the *EE M4 Wireless Transmission Project*

Wesley van den Beld

XUV/TNW

## Motivation

With the rapid rise of generative AI/LLM tools like ChatGPT, students increasingly rely on such systems for academic tasks. While AI offers support, uncritical use may hinder students' ability to independently evaluate information, construct arguments, and **solve complex problems**—skills crucial for engineering education. In response, this SUTQ project investigates how structured **rebuttal-based assignments** can foster **critical thinking** and **AI literacy during the project plan phase.**

## Research Aim

To explore whether integrating rebuttal writing into a project-based engineering module improves students':

- Critical thinking and reasoning skills
- Awareness of assumptions and logical flaws
- Responsible and reflective use of AI tools (LLMs)

## Data Collection & Ethics

Quantitative data: Likert-scale self-assessments

Qualitative data: Written rebuttals and reflections

Ethical approval obtained (opt-out procedure, anonymized data)

## Current status

Updating Project manual to include rebuttal (see data collection)

Consent procedure and data privacy safeguards implemented

Project starts 12 June 2025 with 74 students

Positive early engagement with AI-critical thinking tasks reported by teaching assistants

## Educational Intervention

Integrated into the EE M4 Wireless Transmission Project, the intervention consists of:

**Workshop**

Introduction to critical and design thinking, opportunities and risks of integrating AI/LLM.

**Peer Review**

Students review multiple project plans, one fully generated by ChatGPT (so effectively 1 AI project group)

**Rebuttal Assignment (Individual)**

Students write a structured response to received feedback (human or AI-generated), justifying their choices and reflecting on the critique.

**Embedded Reflection & Self-Assessment**

Students answer short quantitative and qualitative questions on:

Perceived improvement in critical thinking

Type and frequency of LLM use

Awareness of AI's opportunities and risks

## Relevance & Impact

This work supports broader educational goals, including:

- Aligning with the DigComp framework (digital and critical literacy)
- Preparing students for responsible AI use
- Promoting deep learning through peer engagement and metacognition

## Next Steps

Collect and analyze data the intervention in EE M4 Wireless Transmission Project. Evaluate impact on students' argumentation and reflection quality.

Share results through:

- Next Week of Education
- Journal publication
- Adaptation of approach to other project-based modules

## Acknowledgements

Thanks to the SUTQ team, especially Peter Hagenaars, Sonja Borst and Francesca Frittella. And to the SUTQ'ers in my group: Judith Timmer and Fokko Jan Dijksterhuis.

E-mail: w.t.e.vandenbeld@utwente.nl

*** This poster has been created with help from ChatGPT ☺**

# Peer support to improve search quality of students during bachelor project search

*Dr.mr.ir. M. (Marc) van Buiten*

**Peer group attendance** improves search quality, offers mental support, an increased sense of urgency and motivation, a welcome opportunity to ask for advice, and a valuable sense of other students' progress.

*"I think it is a good way to talk with others about it. I do know enough people who are also searching for an assignment to not need those peer group sessions. But they did help me with making the search more urgent and taking bigger steps."*

*"Through talking, it made me realize that we share common worries about the thesis, and it made me feel like I am not alone."*

## 1. Introduction

- Students increasingly struggle to find an (external) bachelor assignment
- Focus groups colleague-perspective (Figure 1) and student-perspective
- To improve the bachelor project search process ("searching hard" and/or "searching smart"), by redesigning the support process, so that students can quickly find a suitable and satisfactory project on which they can ultimately do well (i.e., high speed, fit, satisfaction, and performance)
- More limited aim in this project is to design and evaluate a peer group intervention that seeks to improve search quality ("searching smart")

## 2. Methods

- Within-subjects design with two conditions (baseline support vs peer group support) with search intensity, search quality, and overall self-assessed search performance as dependent variables
- Post-intervention measurement included an exit-survey on peer group support usefulness, self-assessed improvement of search intensity and quality, assessment of increased preparedness for future search, assessment of mental support of peer groups, perceived advantages and disadvantages of peer group support, and suggestions for improvement

## 3. Results

- Search quality and self-assessed search performance higher after peer group intervention. Search intensity not reliably different (Figure 2)

## 4. Discussion

- Preliminary findings on peer groups to support students looking for a bachelor project are encouraging
- Further research ideas and exploration of pilot study results

*Figure 1. Problem exploration (colleague-perspective)*

| Measure | Baseline (n = 10) | | Post-intervention (n = 10) | | t-value | p | Cohen's d |
|---|---|---|---|---|---|---|---|
| | M | SD | M | SD | | | |
| Search intensity | 2.80 | 0.79 | 2.70 | 1.25 | 0.25 | 0.81 | 0.08 |
| Search quality | 2.37 | 0.70 | 2.66 | 0.74 | -2.28 | 0.05 | -0.72 |
| Overall self-assessed search performance | 3.00 | 1.25 | 3.70 | 1.16 | -2.69 | 0.03 | -0.85 |

*Figure 2. Results search quality, intensity, and overall self-assessed search performance across baseline and post-intervention conditions*

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BrightCarbon

UNIVERSITY OF TWENTE. | Fundamental Education Research in Mathematics at Twente

# A TEACHING EXPERIMENT

## STATISTICAL INFERENCE WITH STUDENT-GENERATED DATA

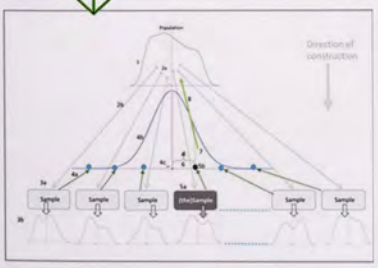
## WHY?

### STATISTICAL INFERENCE

- Essential for advancing in statistics
- Traditionally, scarse focus on conceptual understanding
- Consistent struggle with understanding key concepts

## CONSTRUCTION DIRECTION MODEL (CDM) [1]

Understand the population and parameter → Move to random sampling and sample differences → Build the sampling distribution for inference.




## WHAT ?

### THE EXPERIMENT

Lesson Design: A classroom intervention was designed using the CDM, combining pre- and in-class activities.

Interactive Tools: Live data collection and visualization using digital tools.

Multiple data sources for evaluating learning impact.

## FINDINGS

### STUDENTS

- Showed deeper conceptual understanding of key concepts: sampling, variability, Central Limit Theorem (CLT.)
- Engaged in richer classroom discussions
- Supported peers in skill gaps

"I thought I understood the CLT before… now I really get it."

## TAKEAWAYS

Real-time, interactive sampling boosts engagement

Students benefit from doing, beyond traditional lectures

Future work: Test different sample sizes & strengthen understanding of probability patterns

[1] Kula, F., & Koçer, R. G. (2020). Why is it difficult to understand statistical inference? Reflections on the opposing directions of construction and application of inference framework. *Teaching Mathematics and its Applications: An International Journal of the IMA, 39*(4), 248–265. https://doi.org/10.1093/teamat/hrz014

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Applied Mathematics Department
University of Twente

# STUDENT EMPOWERMENT IN HIGHER ENGINEERING EDUCATION

**PhD Project - CELT - 4TU.CEE**

Candidate: Adina Imanbayeva (CELT)
Promotors: Klaasjan Visscher (KiTeS) and Cindy Poortman (ELAN)
Co-promotors: Marcus Pessoa (CELT) and Robin de Graaf (CEM)

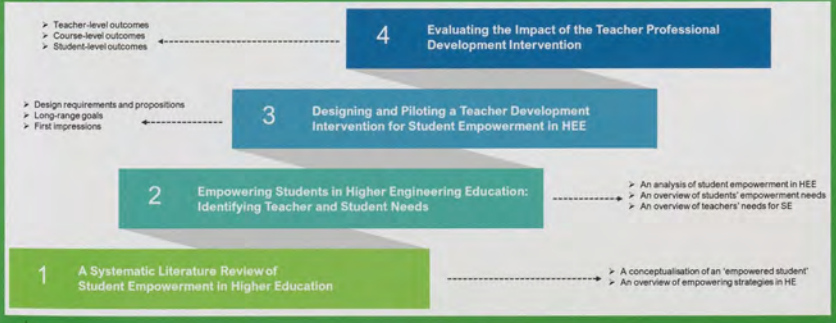
## EMPOWERING STUDENTS TO SHAPE A SUSTAINABLE FUTURE

Higher education plays a crucial role in preparing graduates to address complex global challenges. This demands not only new knowledge and skills but also a shift toward empowering students to take ownership of their learning and future. In Higher Engineering Education (HEE), where engineers are at the forefront of designing innovative and sustainable solutions, empowering students is essential. Research shows that empowered students are inspired and motivated to act, make informed choices, and contribute meaningfully to their communities (Frymier et al., 1996; Schmidt & Baumgarth, 2017).

However, fostering student empowerment does not happen automatically. It requires intentional teaching practices and supportive learning environments shaped by skilled educators. Teachers therefore play a critical role and must be supported through targeted professional development (Van Den Beemt et al., 2023; Maspul, 2024). Therefore, this project aims to design a professional learning opportunity that equips teachers with strategies to foster student empowerment in HEE.

## PROJECT OVERVIEW

### Project Structure




### What Is Student Empowerment? Insights from Study 1

Study 1 explored how an empowered student is conceptualised in higher education, and how student empowerment can be fostered through structured educational activities.

In higher education research, **empowerment takes multiple forms**:

- Empowerment as the Perception of Internal and External Impact
- Empowerment as a Personal Experience
- Empowered Students are Active and Capable Agents
- Empowerment as a Social Experience

Research also identifies key methods and practices for fostering student empowerment:

**Empowering Methods:**

- Active Engagement and Exploration
- Collaborative and Community Learning
- Scaffolding Autonomy
- Empowering Teacher Disposition

**Empowering Practices** :

- Offering Real-World Learning Opportunities
- Conducting Authentic Assessment
- Providing Access to Resources for Independent Learning

### Share Your Insights! Study 2

**Student Empowerment in Higher Engineering Education**

In your view, who is an empowered student in HEE?
*(Think about knowledge, skills, attitudes)*

In your experience, what empowers students in HEE?
*(What educational practices or experiences support empowerment?)*

What hinders student empowerment in HEE?
*(What barriers, challenges, or gaps exist—for students and teachers?)*

## CURRENT STATUS

- Finalising Study 1 Paper
- Interviews with Experts in HEE
- Case Analysis Study 2: CBL in MSc Robotics, UT

## NEXT STEPS

- Case Analysis Study 2: Europe (4TU, ECIU)
- Design and Pilot a Teacher Professional Development Opportunity - Study 3
- Evaluate the TPD Opportunity - Study 4

## ARE YOU CURIOUS TO LEARN MORE OR GET INVOLVED?

- Get in touch! - a.imanbayeva@utwente.nl
- Join the Pilot in Study 3 or Evaluation in Study 4
- Share a Case for Study 2

4TU.Centre for Engineering Education

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# Student-Designed Learning Projects

## Improving Student-Directed Learning – Fokko Jan Dijksterhuis

### Personal Pursuit
Student transforms personal interest into academic educational project

### Feasible
6EC Curriculum Component UCT-ATLAS

### Rewarding
Cherished by community; valued in visitation

### Experiences
Great projects; logistical issues

### Challenges
Difficulties of students to develop feasible projects with proper goals and academic level

### Focus on Activities
What do you learn from doing this?

### Improper Goals
No goal; too generic; too vague

### Inefficient
Students take too long to write proposal

Frontispiece from Benjamin Martin, *The Young Gentleman and Lady's Philosophy* (London 1759).
A brother and a sister use books, instruments and senses to learn together about the world.

### Tutoring
Students develop PP proposal in tutor groups from idea to learning project

### Educational Narrative
Learning journey and learning starting point

### Peer Collaboration
Exchange ideas in heterogeneous groups

### Tutors
Activators that empower students

### Reflection
SUTQ project aimed at learning students to write proper learning goals

### Learning Objectives
Are not a goal, but a means for learning

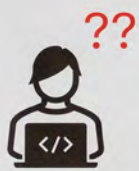
### Self-Directed Learning
PP as platform for learning about learning

### the problem was not the problem
tutoring of design process instead of instructing proposal writing

# Programming on 4CID - A medicine to address problem solving?

*Mark Vlutters*
*(m.vlutters@utwente.nl)*

## Observation




*~120 students*
*Major spread in skill after course*

## Goal

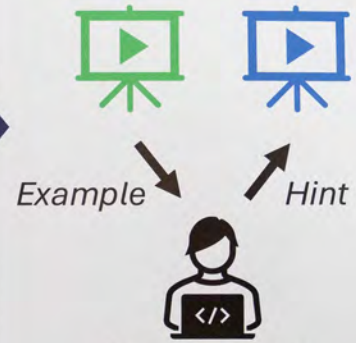
*Enhance students' problem-solving skills in programming*

## 4CID*

*Van Merriënboer et al.*

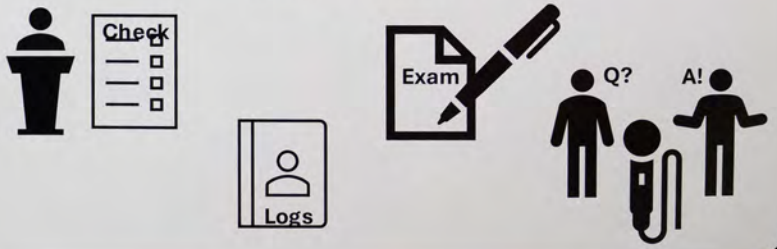
*"supportive"* + *"procedural"*

## Implementation




*New practice problems*

## Data Collection




## Preliminary insights

- Motivating context *over* realistic context
- Videos procedural info *over* videos recurrent info

- Abstraction & translation to code is the hardest
- Procedural knowledge affects problem approach
- Need more part-task practice than you may think

- Expecting too much given time and entry levels?

* ***4**-**c**omponent **i**nstructional **d**esign: 1) real-world learning task(s), 2) supportive info, 3) procedural info, 4) part-task practice.*

# Improving students' scores for stochastic games

Judith Timmer
Programme coordinator B-AM and lecturer
j.b.timmer@utwente.nl

## Challenge

How to improve the students' scores for the stochastic-games questions in the Game Theory exam?

## Background

Game Theory is an elective course in the Applied Mathematics (AM) and Industrial Engineering & Management (IEM) master's programmes.
The stochastic games part builds on discrete-time Markov chains prior knowledge from the bachelor's.

## Method

**Interventions** to refresh the preknowledge on discrete-time Markov chains.
**Interviews** with students (before and after intervention) and co-teacher.
**Quantitative data** analysis of SEQ and test scores.

## Interventions

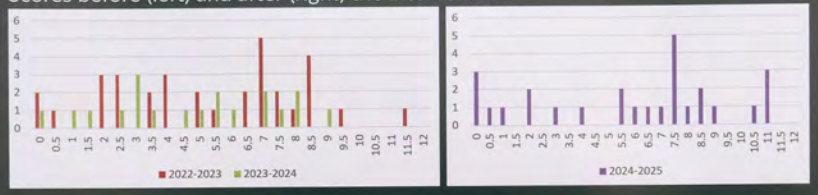
In two weekly lessons in Canvas, the students

- are informed of the weekly prerequisite skills and books covering these,
- watch a video showing how to apply each prerequisite skill in a problem,
- try several practice questions, and
- do a quiz to test how well they master the weekly skills.

Tools used: just-in-time teaching [1], blended learning [2]

## Results

Scores before (left) and after (right) the intervention




Scores' characteristics per academic year, out of 12

| acad. year | minimum | maximum | median | average | st.dev. | number of tests |
|---|---|---|---|---|---|---|
| 2022-2023 | 0 | 11.5 | 5.5 | 5.29 | 2.91 | 33 |
| 2023-2024 | 0 | 9 | 6 | 4.76 | 2.54 | 19 |
| 2024-2025 | 0 | 11 | 7 | 5.85 | 3.56 | 27 |

'How well did this course match with your prior knowledge?', SEQ question 3.3

| acad. year | 'not at all' 1 | 2 | 3 | 4 | 5 | 'very well' | *n* | average | st.dev. |
|---|---|---|---|---|---|---|---|---|---|
| 2022-2023 | 0.14 | 0.29 | 0.00 | 0.29 | 0.29 | | 7 | 3.29 | 1.48 |
| 2023-2024 | 0.11 | 0.22 | 0.22 | 0.11 | 0.33 | | 9 | 3.33 | 1.41 |
| 2024-2025 | 0 | 0 | 0 | 0.43 | 0.57 | | 7 | 4.57 | 0.49 |

## Conclusion

The students' scores for the stochastic-games part improved after the interventions.

## Results

**Test scores**
The test scores show higher median and average scores compared to previous years.
Students indicate a better match with prior knowledge.
**Interventions**
First weekly lesson: eight students took the quiz. Many correct answers.
Second weekly lesson: three students took the quiz. Answers ranged from all wrong to all right.

## Discussion

- More AM students participated this year.
- Hard to measure participation in interventions in Canvas.
- Measurements of the interventions' effects could be fine-tuned.

## Conclusion

The students' scores for the stochastic-games part improved after the interventions.

## References

[1] Bertrand, E., McArdle, D.T., Thoma, L. and Wu, L. (2021) Implementing Online Programs in Gateway mathematics courses for students with prerequisite deficiencies, *PRIMUS* 31 (2): 119–132.

[2] Helsa, Y., Darhim, Juandi, D. and Turmudi (2021) Blended learning in teaching mathematics, *Aksioma* 10 (2): 733–743.

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# TRAINING SCIENCE COMMUNICATION SKILLS AND INSIGHTS

## Evaluating a Fundamentals course – Anne M. Dijkstra

### Context

Societal changes contest contributions of science and scientists. Additionally, scientists' career assessments are not only based on publications anymore. Researchers need to be more engaged with society which requires science communication skills. Literature shows that training and institutional support are largely lacking. A fundamentals course was developed as a start for filling that gap.

### Course material

- TGS course Fundamentals of Science Communication and Citizen Science
- 2 ECTS (56 hours)
- For PhD students and early career staff
- 4 sessions of 3 hours, online Nature course is embedded, assignments, reflections
- Skills and theoretical background

### Concepts from literature*

**Key learning objectives** = what students should know and be able to do
**Threshold concepts** = rich concepts which are key to proceed in learning
**Learning progressions** = pathways of learning that form a framework showing what learners know and can do
**Community of Practice** for science communicators = groups that they can belong to (* e.g. Lewenstein & Baram-Tsabari, 2022; Hudson, 2020; Wenger)

### AIM and Research Question

To evaluate the existing content based on concepts from literature in order to design a course that addresses basics of science communication skills and theory.
RQ: What should a fundamentals course address? And how?

### Mixed methodology

1. Review of learning objectives based on Lewenstein & Baram-Tsabari (2022)
2. Interviews with course participants
3. Survey questionnaire with uni staff
4. Redesign and expert feedback
5. Final redesign

### Keywords

Professional development, higher education, science communication training, threshold concepts, learning progression, occasional science communicators

### Credits visualisations

LUVANE



### About the researcher

Anne M. Dijkstra is associate professor in science communication, leading the Research Centre for Science Communication and Engagement. More info:

UNIVERSITY OF TWENTE.