

## PROMOTING THE EXPERIMENTATION-RELATED SELF-EFFICACY EXPECTATION. AN EXPERIMENTAL STUDY

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### Introduction

- Access to incremental scaffolding in learning environments promising for promoting self efficacy (SE) → enables experience of autonomy and competence (Stiller & Wilde, 2023).
- Lower self-efficacy of females regarding specific STEM-associated topics and domains compared to males.
- SE eminent predictor of e. g. goal choice, effort in reaching goals, and persistence in pursuing goals (Bandura, 1997; Luo et al., 2021) → Promotion is needed.
- Interdisciplinary topic of climate change does not tend to trigger gender-related dynamics → potential to address STEM-related topics and domains implicitly.
- Participation in climate change discourse affords specific competencies, e. g. experimentation competence → experimentation-related self-efficacy (expSE) as motivational aspect.
- Students with high SE are more likely to seek help than those with low SE (Roussel et al., 2011).
- Females report lower SE and are more likely to seek help than males (Morgan et al., 2003; Ryan et al., 1998).
- Highest impact of seeking help on achievement for students with low SE. No findings regarding the influence on SE (Broadbent & Howe, 2023).

### Objective & Hypotheses

Are there gender-specific differences in promoting experimentation-related self-efficacy through incremental scaffolding?

#### Hypothesis 1:

“Students who use incremental scaffolds show a higher increase in experimentation-related self-efficacy than those who do not.”

#### Hypothesis 2:

“Experimentation-related self-efficacy of females and males is equally promoted through access to incremental scaffolds.”

#### Hypothesis 3:

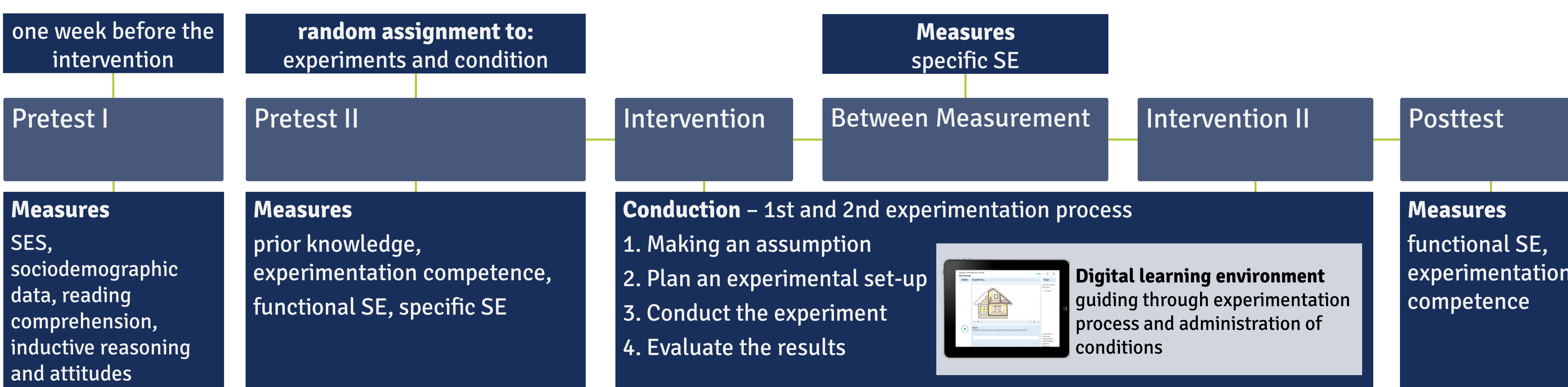
“Students who report lower experimentation-related self-efficacy are less likely to access incremental scaffolds.”

#### Hypothesis 4:

“Students who report lower experimentation-related self-efficacy and access incremental scaffolds report the highest gain of experimentation-related self-efficacy.”

### Methodology experimental design with two predictor variables

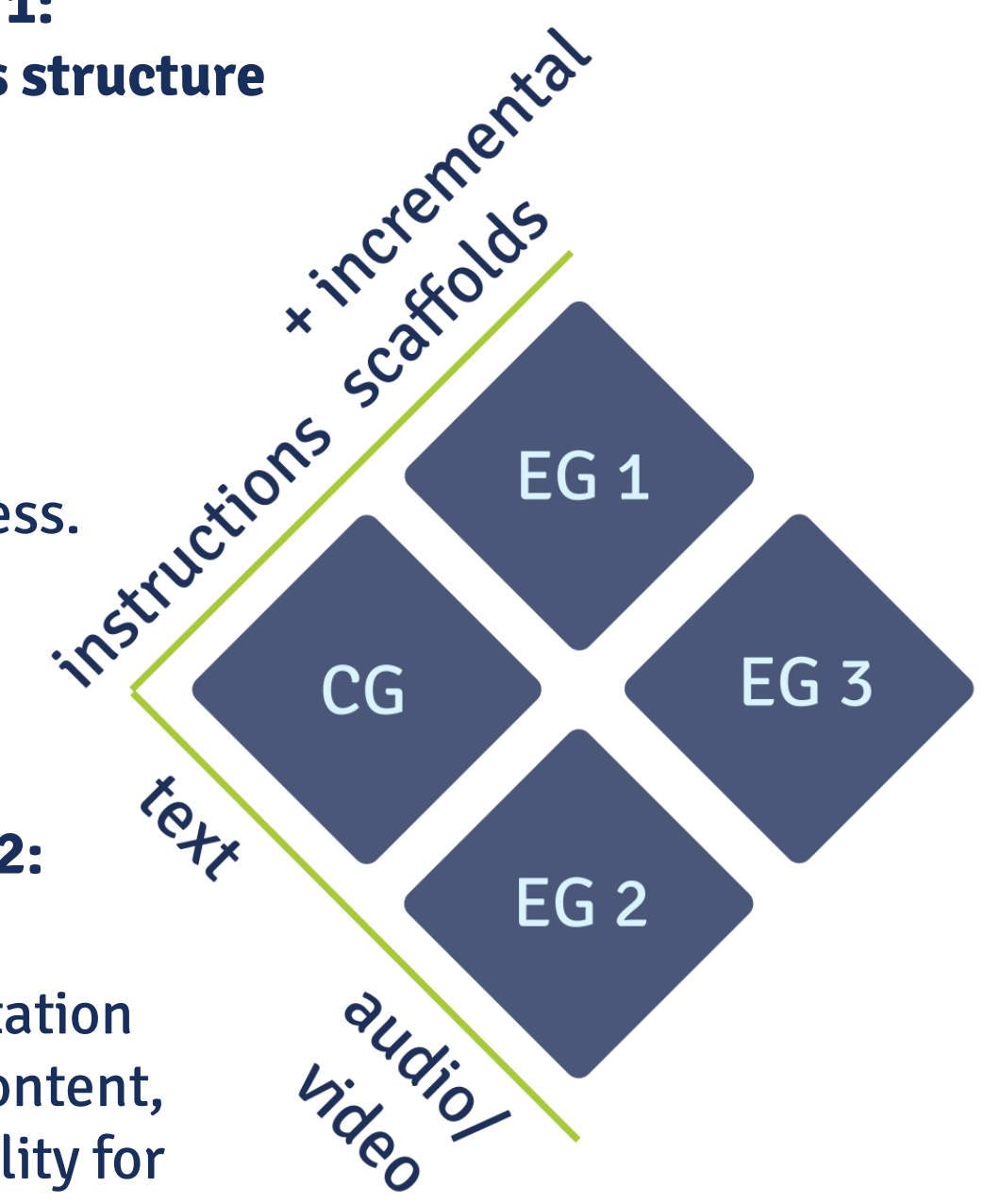
Pilot:  $N = 108$  ( $M = 13.1$ ;  $SD = .67$  years; 49 % female)



### Conditions

#### Independent variable 1: Incremental scaffolds structure

1. Hint
  2. Example
  3. Solution
- for each phase of the experimentation process.



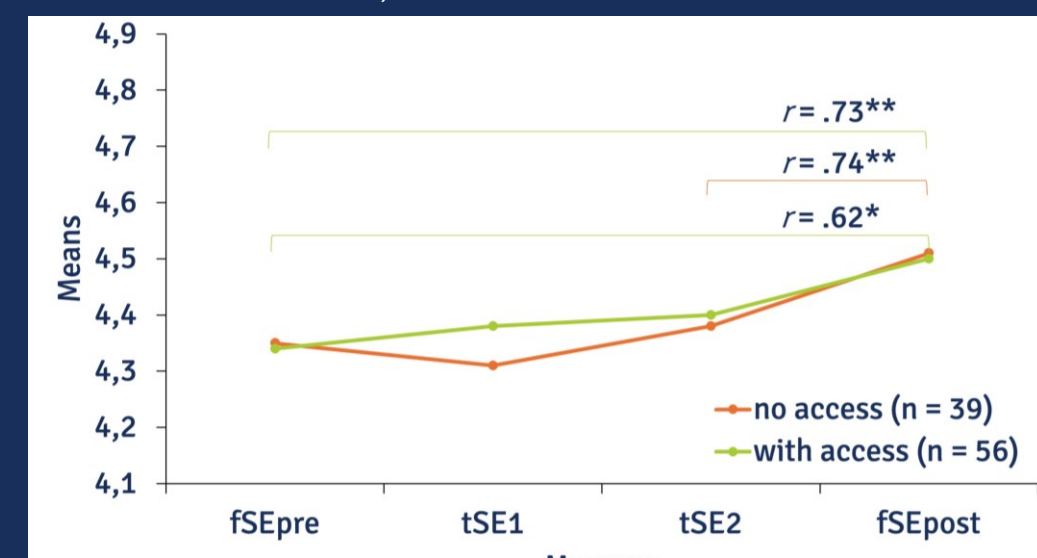
#### Independent variable 2: Representation form

Multimedia implementation (Mayer, 2022) of the content, to guarantee accessibility for every learner.

### Results

#### Hypothesis 1

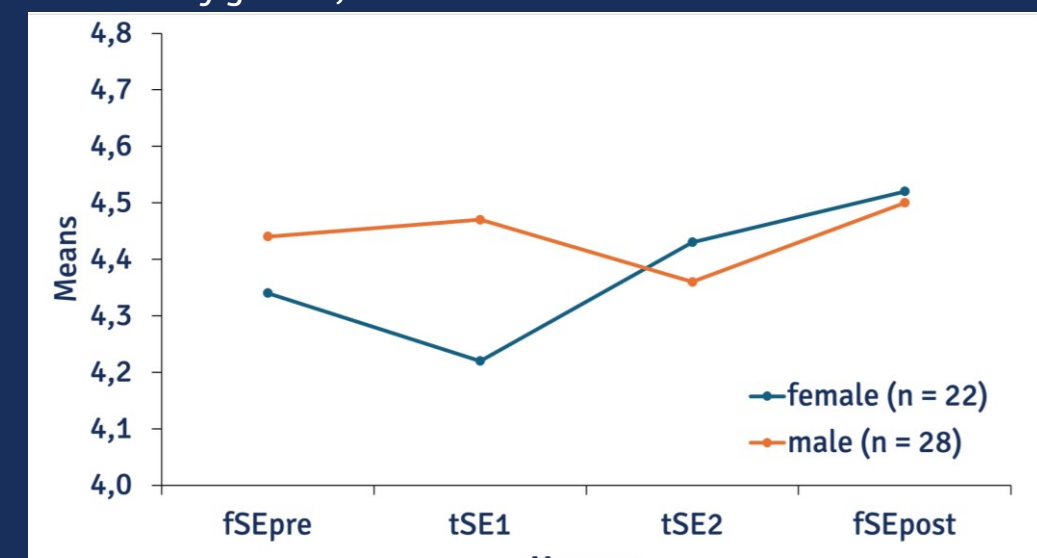
Development of expSE with and without access to incremental scaffolds,  $n = 95$ .



Note. Means of functional and task-related self efficacy before (fSE<sub>pre</sub>), during (tSE<sub>1</sub>, tSE<sub>2</sub>) and after (fSE<sub>post</sub>) intervention are shown differentiated by access to incremental scaffolding;  $r =$  Cohen's (1988) effect size.

#### Hypothesis 2

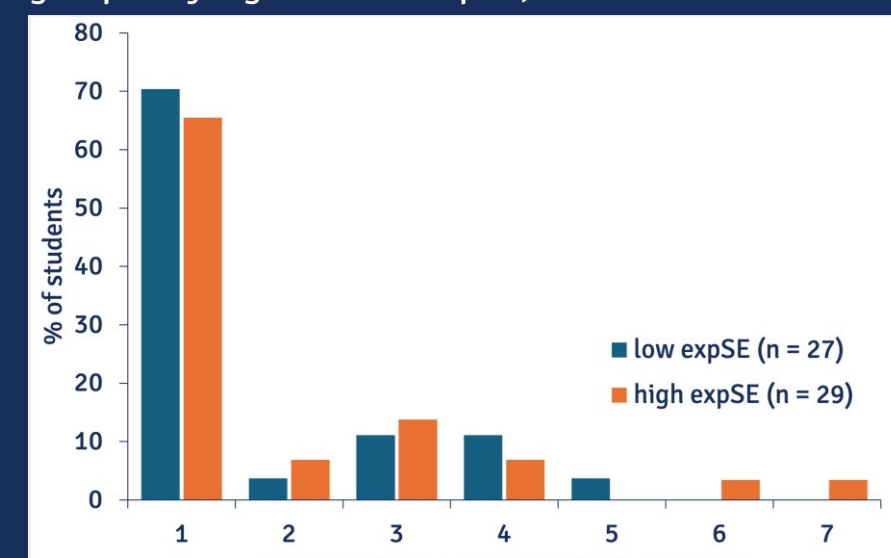
Development of expSE with access to incremental scaffolds by gender,  $n = 50$ .



Note. Means of the measurements of functional and task-related self efficacy before (fSE<sub>pre</sub>), during (tSE<sub>1</sub>, tSE<sub>2</sub>) and after (fSE<sub>post</sub>) intervention are shown differentiated by gender.

#### Hypothesis 3

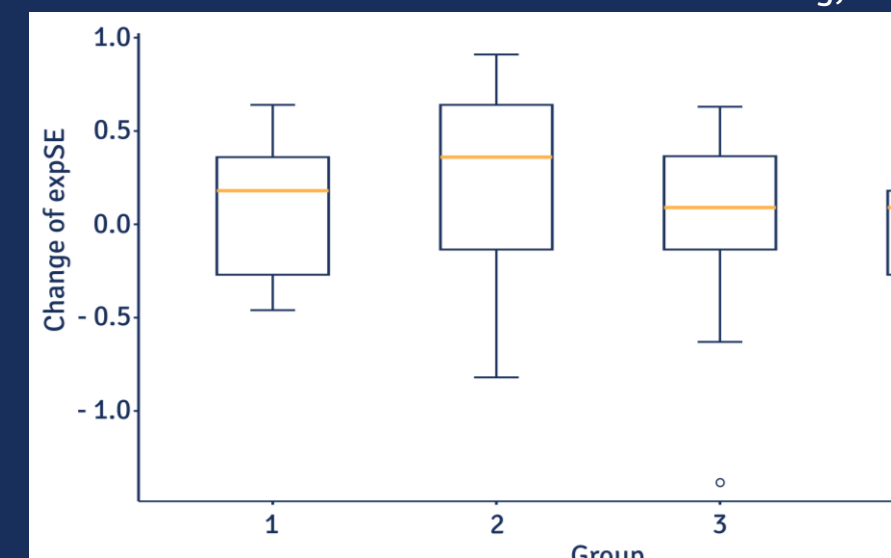
Relative frequencies of accessed incremental scaffolds grouped by high and low expSE,  $n = 48$ .



Note. The percentage of students that accessed x incremental scaffolds are shown for students with high or low experimentation related self efficacy.

#### Hypothesis 4

Change of expSE grouped by high and low expSE as well as by accessed and not accessed incremental scaffolding,  $n = 44$ .



Note. 1 = low expSE/not accessed scaffolds ( $n = 13$ ), 2 = low expSE/accessed scaffolds ( $n = 7$ ), 3 = high expSE/not accessed scaffolds ( $n = 15$ ), 4 = high expSE/accessed scaffolds ( $n = 9$ ).

### Discussion

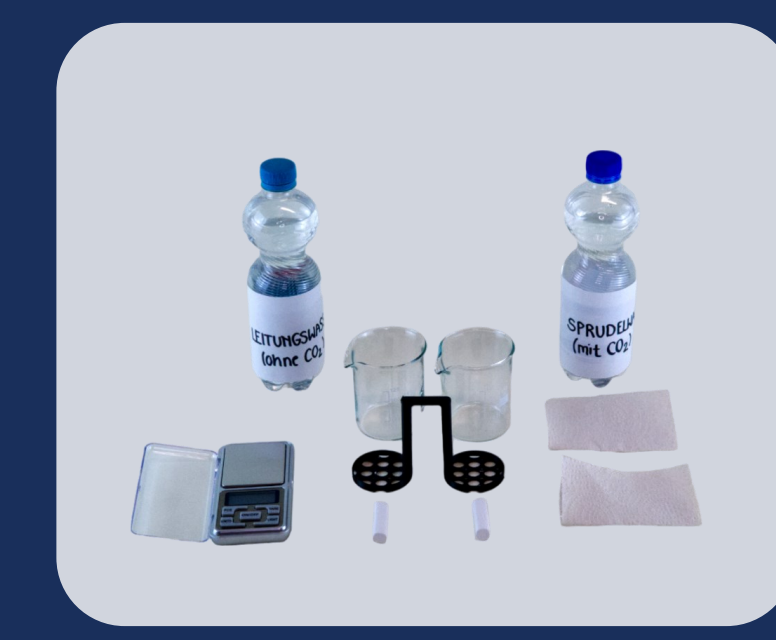
Access to incremental scaffolding is not superior to no access in promoting self-efficacy expectations. A significant increase in SWE was observed for learners with access to help,  $r = .51$  and  $p < .05$ , but with a lower effect size compared to learners without access to help,  $r = .69$  and  $p < .00$ . Learning environments with lower complexity may have less potential for cognitive overload and therefore may have facilitating effects rather than detrimental effects on expSE (Evans et al. 2024).

ExpSE of females and males was not promoted equally through access to incremental scaffolds, since there was no increase of expSE observable in gender-specific analyses. Our research findings suggest that both genders are not disadvantaged.

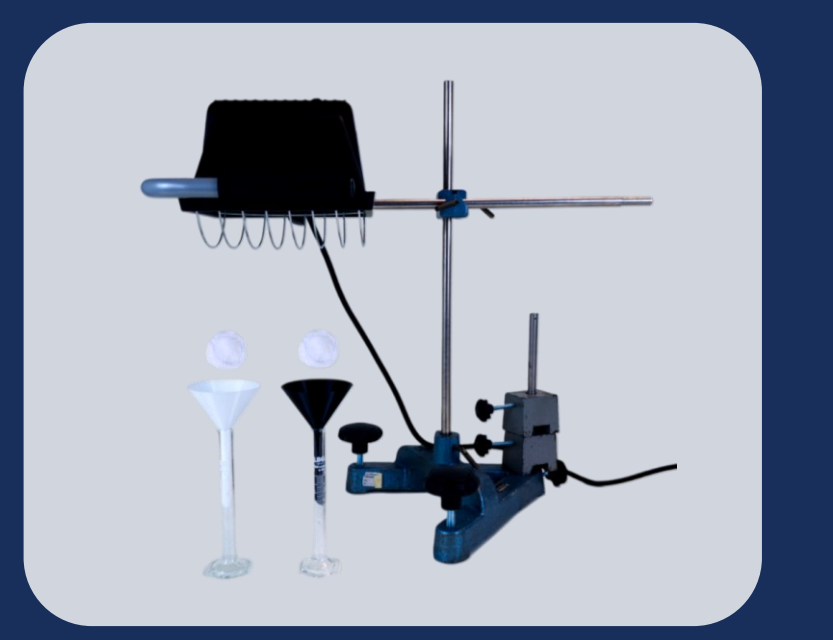
The majority of students did not access incremental scaffolds at all. Furthermore, finding no effect could be a result of the small sample size. The same could apply to interpreting the findings resulting from the fourth hypothesis (Cohen, 1988).

Further explanatory approaches and future research indications: Insufficient aggregation: Students in the multimedia + incremental scaffold condition did not access one incremental scaffold. Examining this distinction may lead to different results.

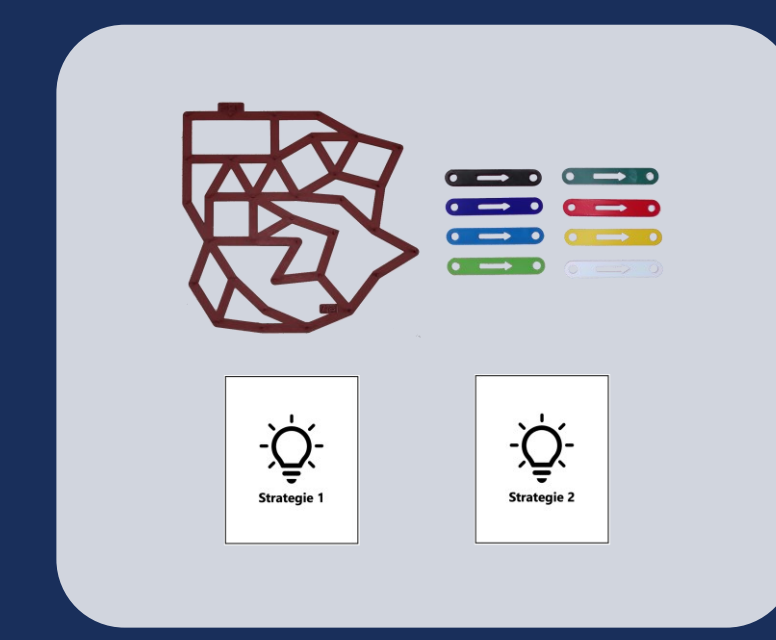
### Experiments



ocean acidification



glacier melting



resource-efficient route planning



thermal insulation

### References

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### Project Partners



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