Science education via Citizen Science: Examples from cooperations with high schools

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Background

- 30% of Austrian citizens have limited trust in science
- Limited interest in science
- Limited under-standing of how science works

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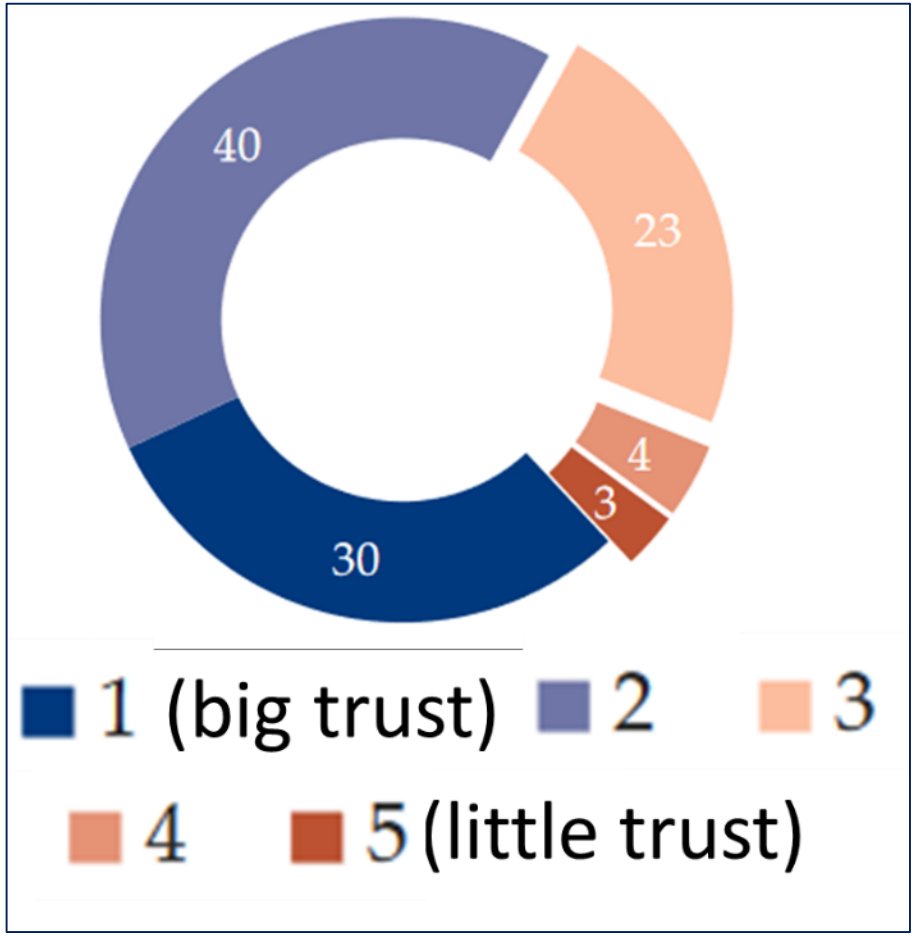
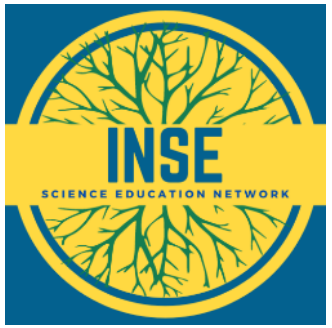
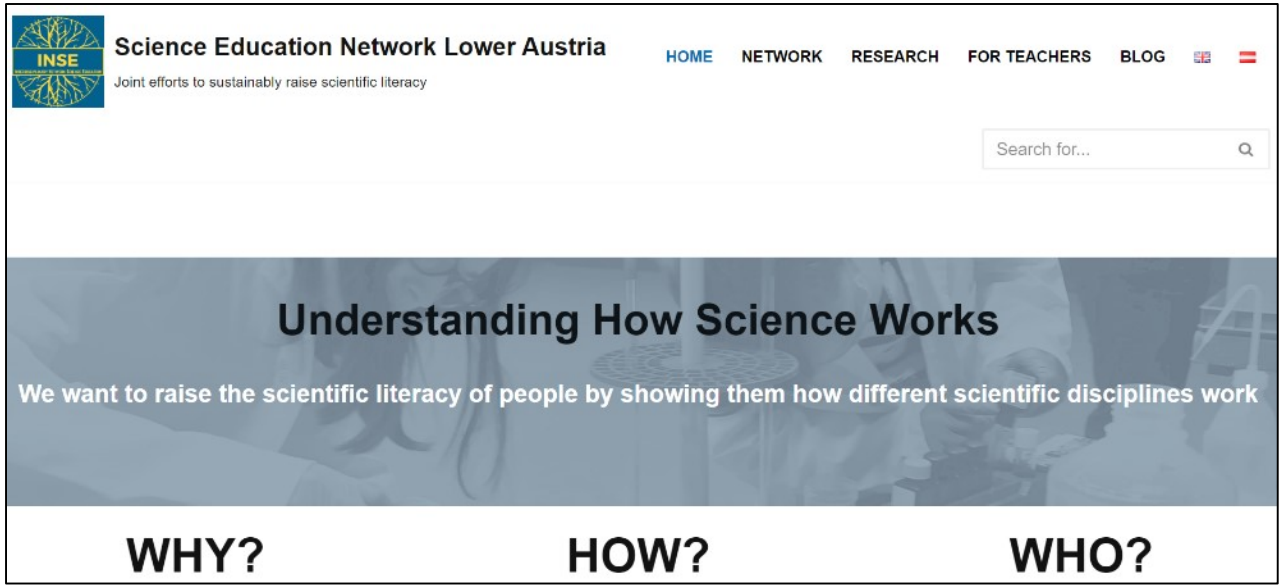


INSE – Interdisciplinary science education network

- Raise school student's and the public's understanding of science
- Correct misconceptions about science
- Strengthen the belief in the benefits of science
- Promote science education at schools
- **Develop projects with international partners**





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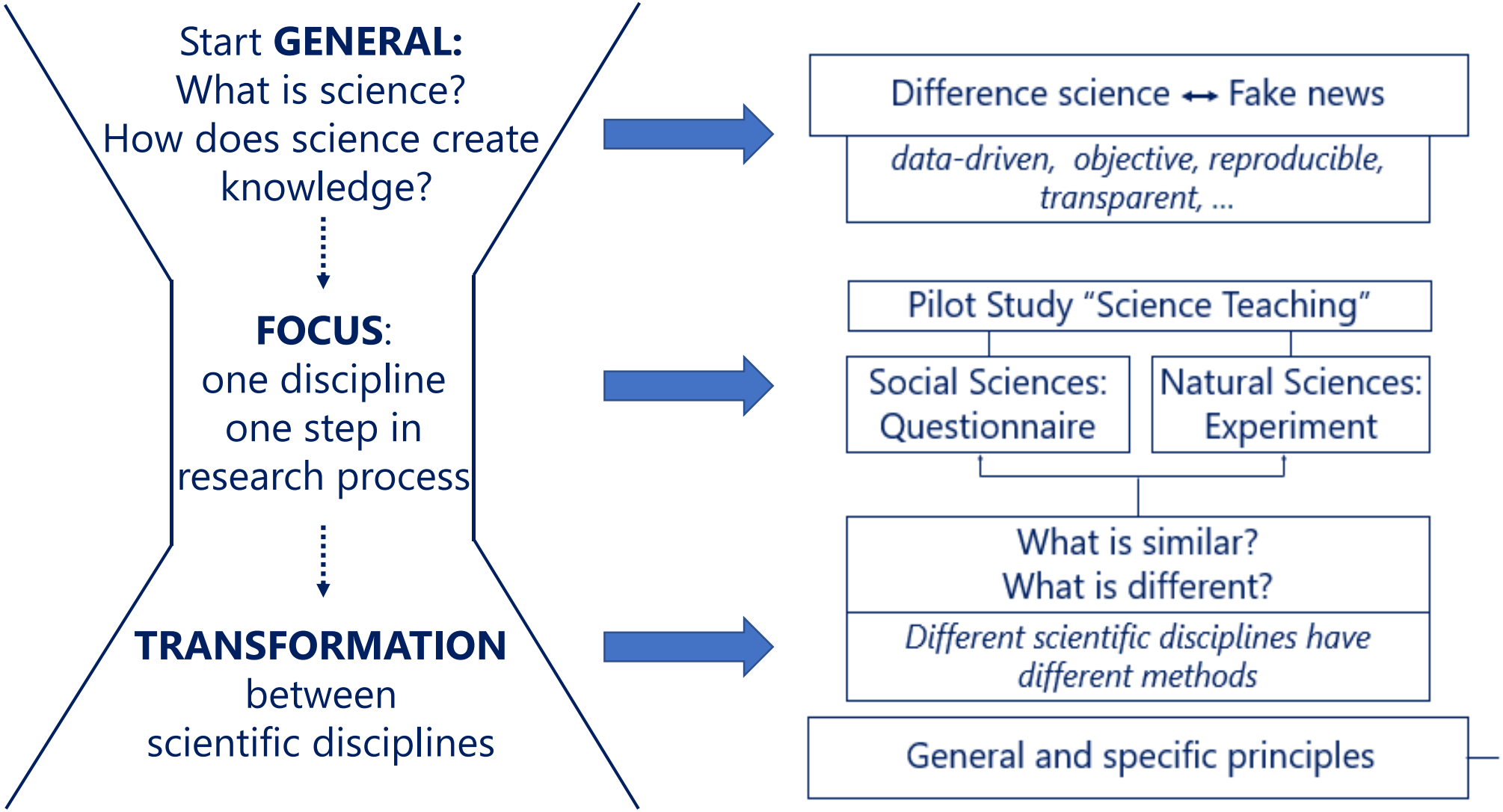
http://science-education.at/

Approach

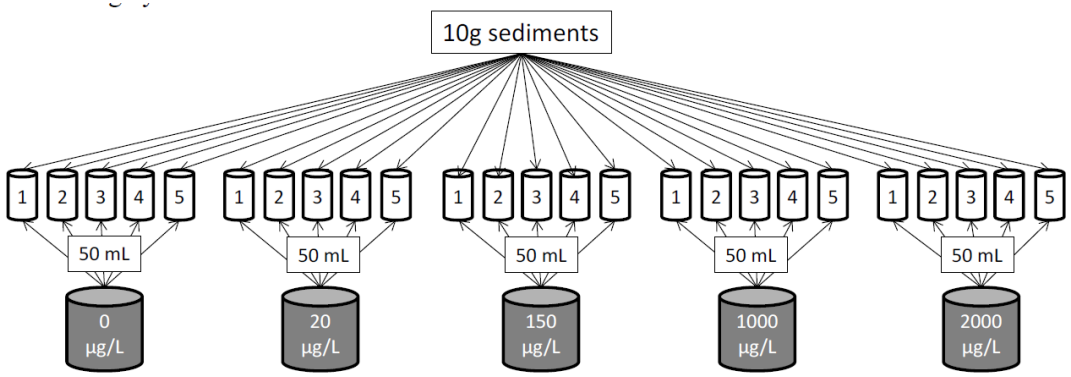

Start **GENERAL:**
What is science?
How does science create knowledge?
FOCUS:
one discipline
one step in research process
TRANSFORMATION
between
scientific disciplines
Difference science ↔ Fake news
data-driven, objective, reproducible, transparent, …
Pilot Study "Science Teaching"
Social Sciences: Questionnaire
Natural Sciences: Experiment
What is similar?
What is different?
Different scientific disciplines have different methods
General and specific principles

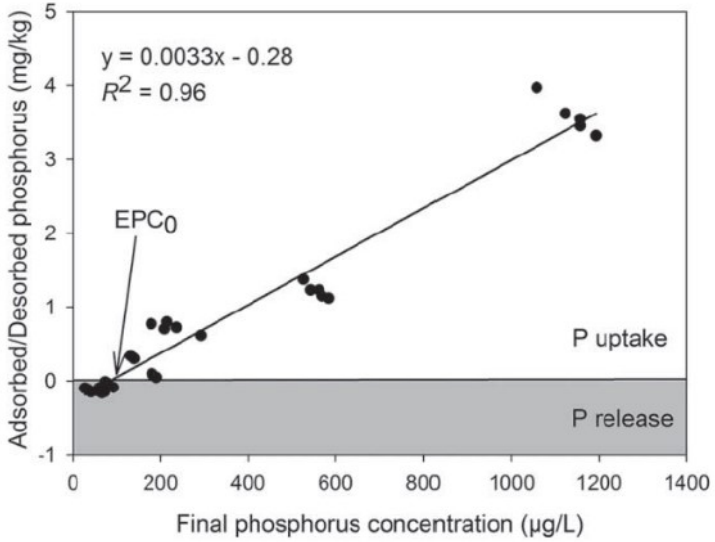
Example 1: Citizen Science with high school classes

- Aim: **Effects of agricultural land use on the P adsorption capacity of sediments via laboratory experiments**
- 5 general high school classes with 20-30 students (16 and 17 y old; total of 115 students)
- 3 Vocational high schools: Advanced in chemical methods, basics in ecology
- 2 General high schools: Advanced ecology, basics in chemical methods
- -> Training in the lab via preparation of standard rows

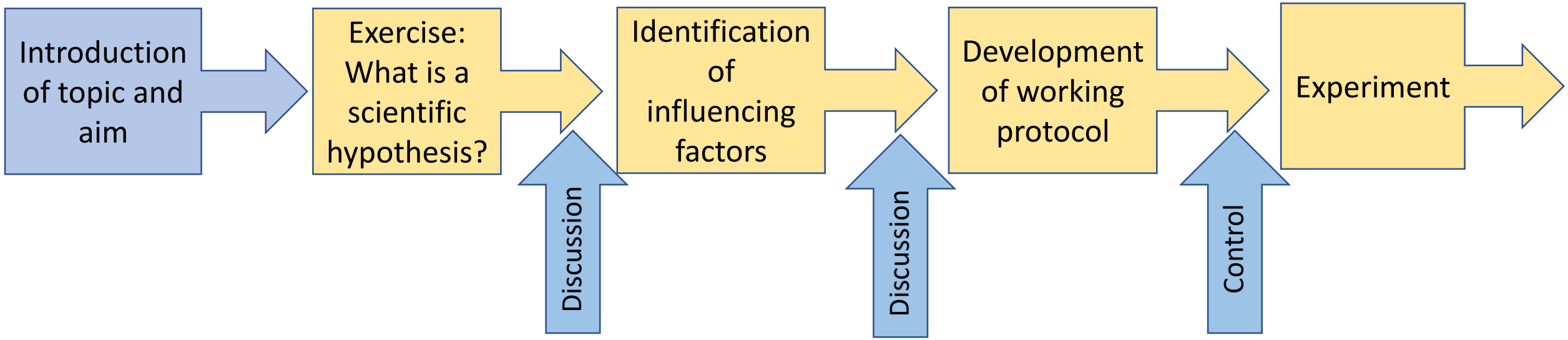
Example 1: Method

- Preparation of phosphorus solutions with increasing concentrations
- Incubation of sediments in the solutions over 24 h in the dark
- Estimate amount of phosphorus taken up or released via difference between start and end
- Plot amounts against end concentrations





Example 1: Procedure and outcome



- *I **understand** better how scientists work* 100%
- *I am **proud** of being part of a science project* 100%
- *I am interested in studying biogeochemistry* 15%
- one technical paper, one CS paper

Example 2: Citizen Science with high school students

- Aim: **Effects of desiccation on the denitrification efficiency of bioreactors**
- 4 students with advanced lab experience
- 2 lab experiments, one in the school, one in our institute

New:

- Students were involved in the design, testing and optimization of the experimental set-up
- Students were responsible for the experiment (worked on their own after training)
- Students analysed the data for their **school thesis** and presented the results

Example 2: Method and outcome

- Construction of denitrifying bioreactors filled with wood chips
- Flow-through mode with nitrate enriched stream water
- Flow interruption for 4 weeks
- Analyses of water and greenhouse gases before and after the flow interruption

- *“Exciting, proud to be part of a scientific study, learned a lot, understand science better, was envied by others….”*
- one technical paper, pre-scientific school thesis of 4 students

Further examples with school classes

- In-stream nutrient uptake experiments via plateau additions
- Hydro-morphological assessments
- Greenhouse gas emission measurements in the field with static chambers
- Respiration experiments in the lab with Microresp chambers or oxygen consumption measurements with wireless sensor spots

-> **simple methods that require a lot of work**

Further examples with individual school students

- Desiccation experiments in the lab and in out-door flumes and analyses of biofilm respiration, extracellular enzyme activities, chlorophyll-a
- Lab experiments about warming effects on the nutrient uptake/release from sediments
- Effects of woodchip bioreactors on nutrient uptake in outdoor flumes

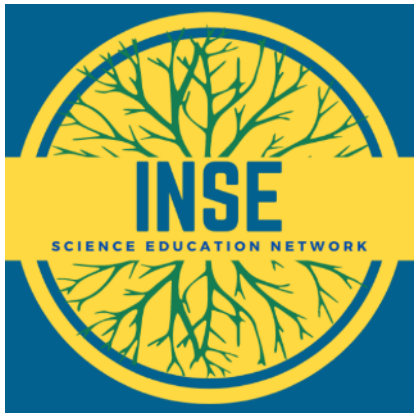
-> **advanced methods that require advanced knowledge and skills and long-term involvement**

-> intrinsic motivation via pre-scientific thesis

-> students have won several awards

Future plans

- Citizen Science project with schools about climate change effects on benthic insects' diversity and food quality
- Couple CS involvement with system thinking education (e.g. DynaLearn)
- Evaluate the effects of CS involvement and/or system thinking education on scientific literacy
- Transform scientific methods between scientific disciplines
- Exchange with colleagues about experience and extend our network
- **Develop joint international projects**



Thank you

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