To See Reason:
Technology Teachers' Guidance and Students' Reasoning in the Design Process

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How do we stop eutrophication of the Baltic Sea?
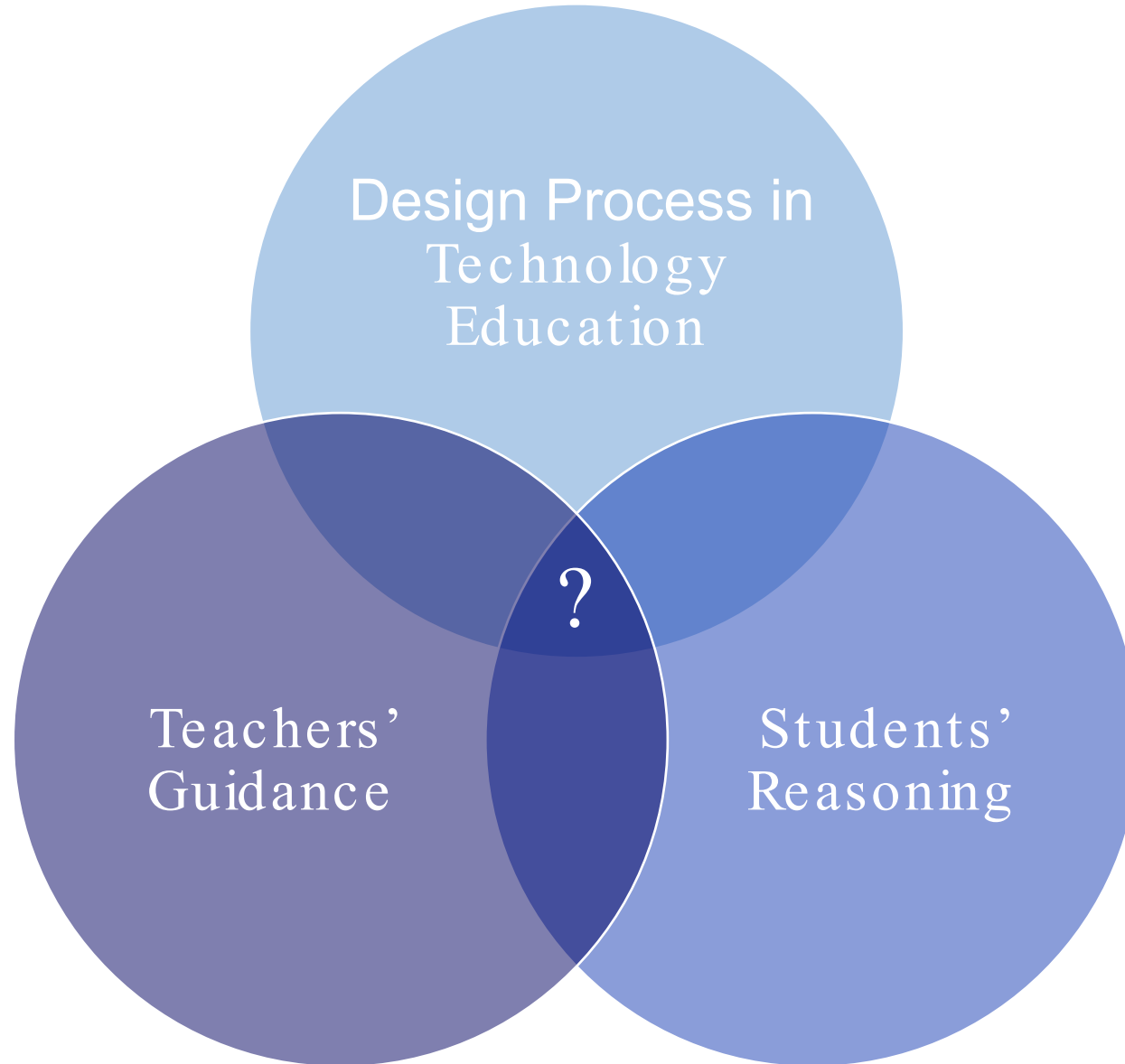
How do we stop eutrophication of the Baltic Sea?

"We have to stop pooping !"

Where had I been?

Research question

What teacher guidance emerge in teacher-student interactions in relation to students' reasoning in the design process?

Design Process

Consecutive actions made to reach a final goal of a mission - "a myriad of observed activity " (Seery et al., 2022)

Reasoning

- The process behind a conclusion
- Students' verbal expression of reasoning
- Reasoning types : Means-end reasoning and cause-effect reasoning

Teachers

Teacher interventions: The episode that follows when the teacher or student initiate communication

Data collection

- Observations of two lessons

- Complete observer

- Two cameras in the classroom

- One microphone on the teacher

- One microphone in each student group

Data analysis

- Thematic analysis

- Audio and video jointly transcribed with focus on the teacher

- Relevant teacher interventions was selected

- Coding using model for reasoning: Means-end reasoning and cause-effect reasoning

- Constructed themes

Context

Bob

Taught a ninth grade class and they were working with designing a ventilation system for a location of the student's own choice. During the observed lesson, the 17 participating students were making physical models.

Peter

Taught a ninth grade class, who were designing their dream house. There were 14 students participating during the observation, and most of them very working on their drawings of their house.

Findings

Giving answers

Asking questions

Showing their reasoning

Giving answers

…through counter questions

Alex:	Peter, I have a question for you. Is it actually good with many windows in a house?
Peter:	Many windows?
Alex:	Yes
Peter:	Why would it be bad?
Alex:	Doesn't it lower the [insulation effect]? You know, they take up space on the wall.
Peter	Yes, so the insulation effect does definitely get worse. But what do you get with many windows? [Pause] Light!

Giving answers

…through a vague answer

Maria:	Should there be a piece of wood under this one too?
Bob:	You decide. You are the project manager. Nobody should tell you what to do. What your design looks like is up to you.
Maria:	Mhm

…through providing conslusions

Isabel:	But then I would add stairs?
Peter:	Yes, it's just one step. If you have 0.3.
Isabel:	Yes, but if I then had a ramp. Or would I […] Would I build it down?
Peter:	For the garage, then it's better to bring the garage down to ground level and then you have no foundation.
Isabel:	So I do this directly? [Points to the drawing]
Peter	Yes

Asking questions

… to check-up

Bob:	How did it go for you, [name of student]? Did it go well? Or so-so?
Kim:	Yes I am trying to fix this piece
Bob:	Okay
Kim:	But the glue didn't work very well

… to challenge

Bob:	Wood piece underneath? [Shows with a wood piece]
Nina:	It is here [points to the wood piece]
Bob:	Why do you use that small wood piece?
Nina:	Because it doesn't need to be lifted up, so it doesn't go up like that. [Shows steep slope with model]. It is quite close.

… to confirm

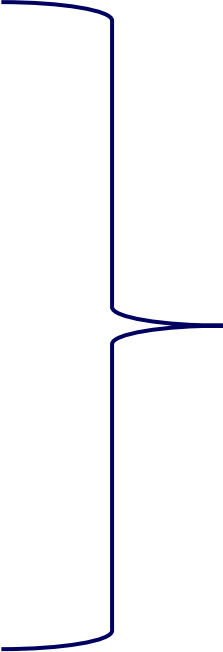# Showing their reasoning

…when making corrections

Bob:	How many should you have? You must put two
Kim:	Two?
Bob:	Yes, we raise it a bit more
Kim:	Yes okay, yes but I will do it

…when providing support

Nour:	Is it good? Should I write about my choice of windows and stuff too?
Peter:	Yes, you can do that. The most important thing is the walls. But there are windows on the walls, and since windows are the most poorly insulated part of a wall, you can write about the windows and the impact of choosing energy-efficient windows or not.
Nour:	Should I link the pages at the bottom?

So?

- Asking **counter questions** …

- Asking questions to **check-up**

- **Challenging** students' conclusions

…occurs in connection to verbal expression of students' reasoning