Authenticity in integrated STEM education – boon or fantasy?

Observing upper secondary technology classroom practice

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Authenticity in integrated STEM education – boon or fantasy?

- Aim: *to investigate the implementation of an integrated STEM project in the Technology Programme at a Swedish upper secondary school.*

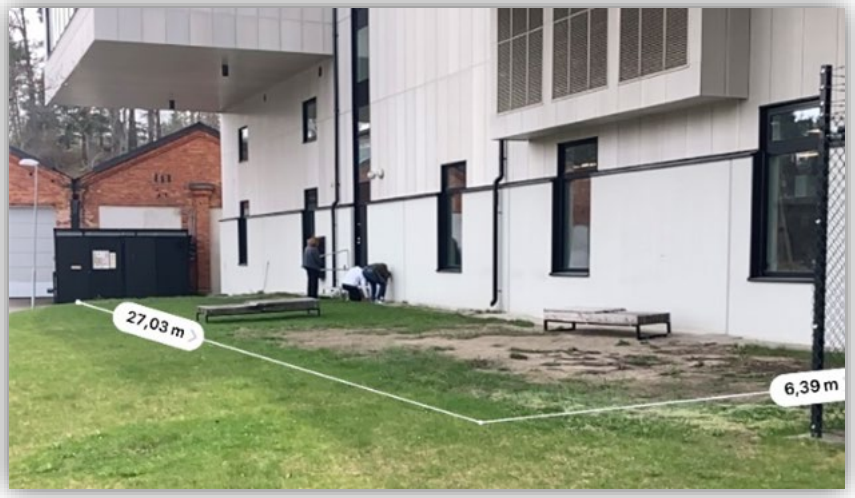
- Participatory observations, teacher and student interviews.

What is unique and novel about this project?

- Upper secondary level (voluntary)
- Cross-disciplinary project groups
- All students in year 1 took part in the project
- Technology programme students was the majority

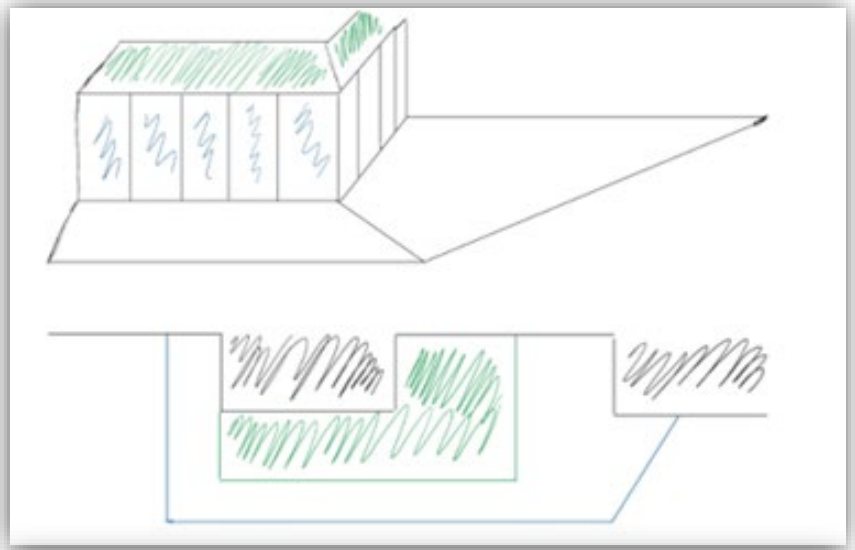
Student project

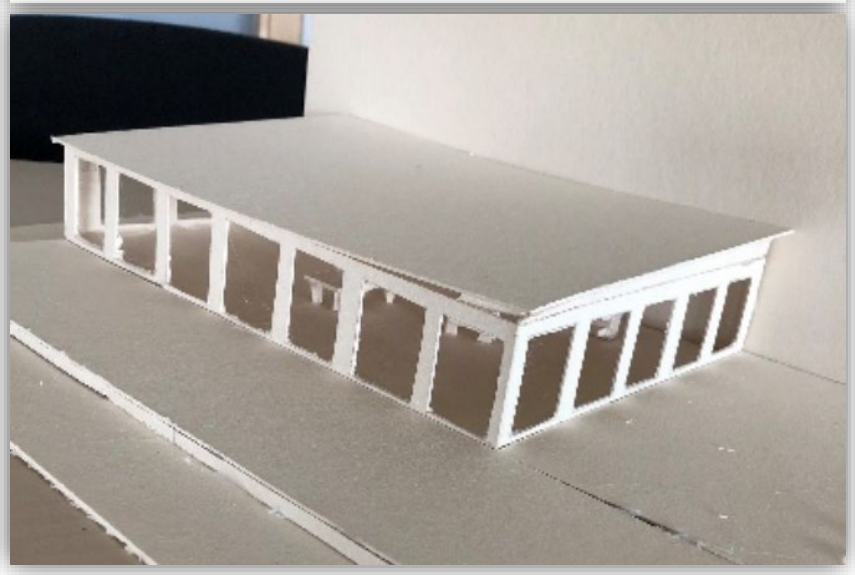
- An engineering design project
- The design of an indoor or outdoor environment that should promote good health.

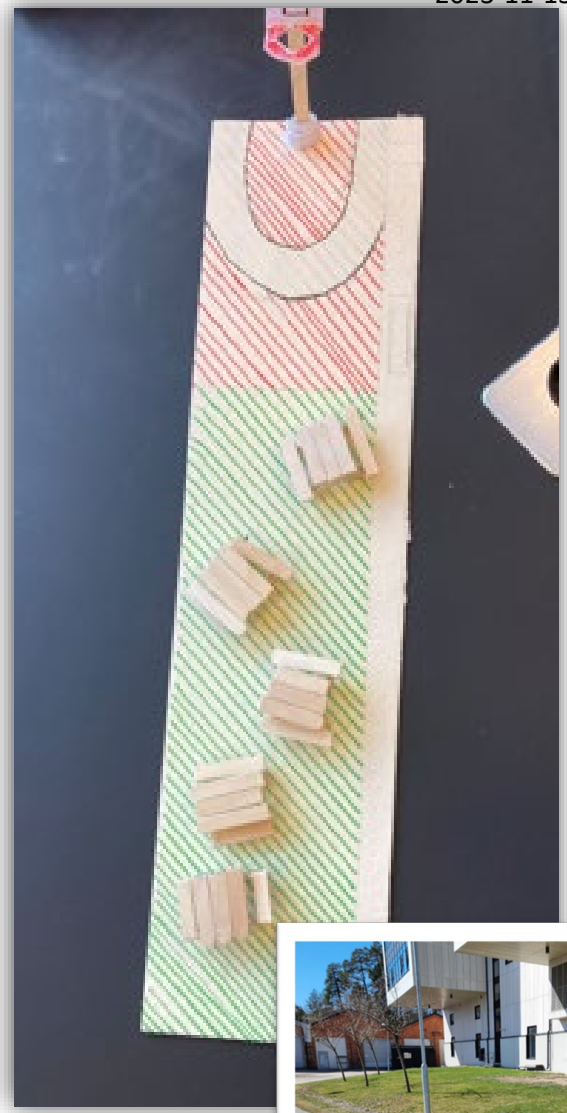


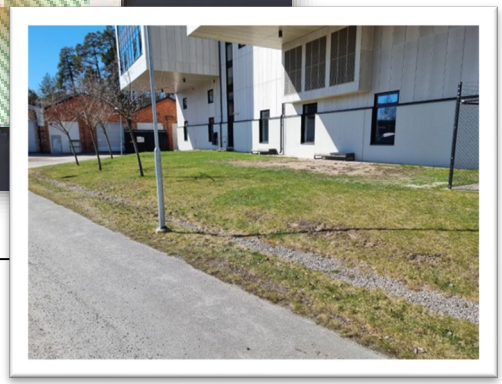
Project overview

	Student Activities	Data collection type
1st week	Introduction Solution suggestions Idea pitch	Teacher interviews (before commencing) Observations
2nd week	Physical modelling	Observations Teacher interview
3rd week	Preparation for final presentation Final presentation	Observations Student interviews
4th week	Reporting	Teacher interviews (after completion)







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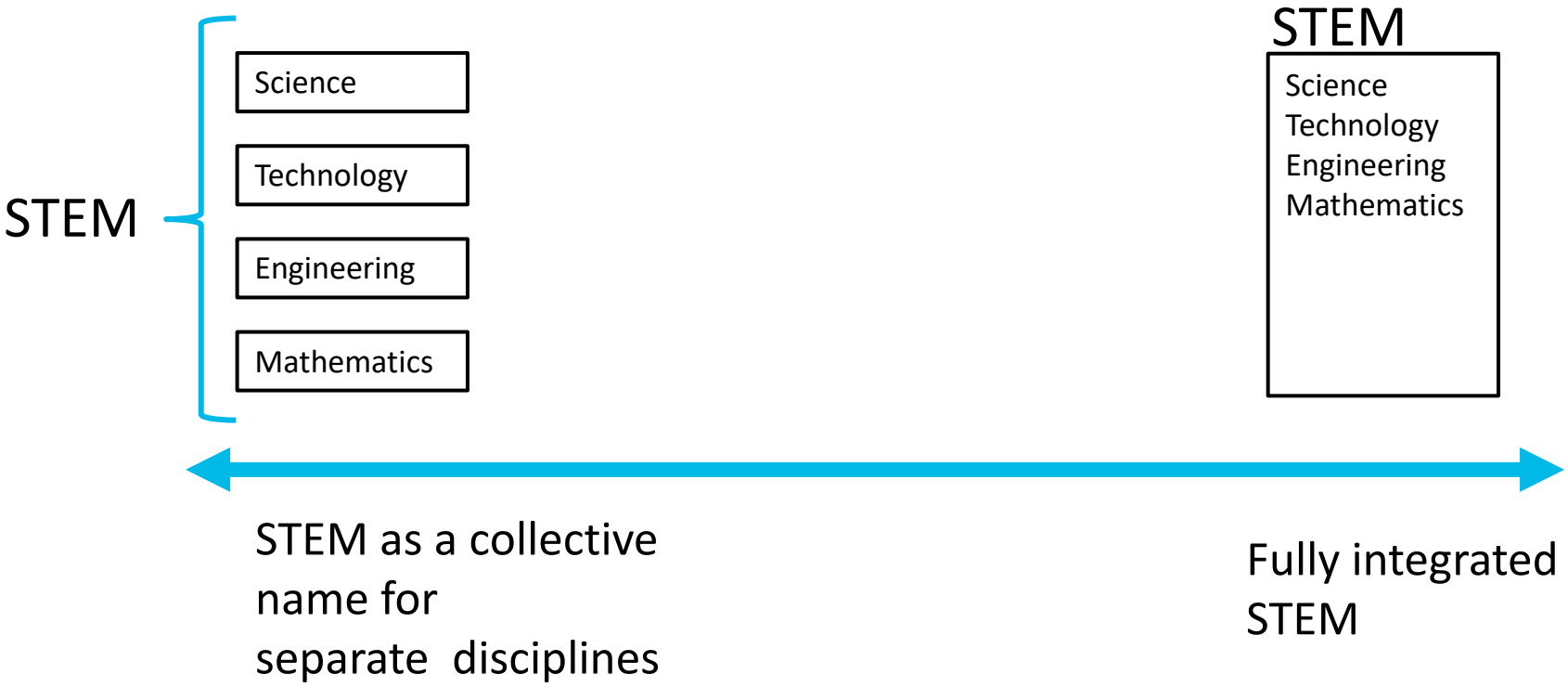
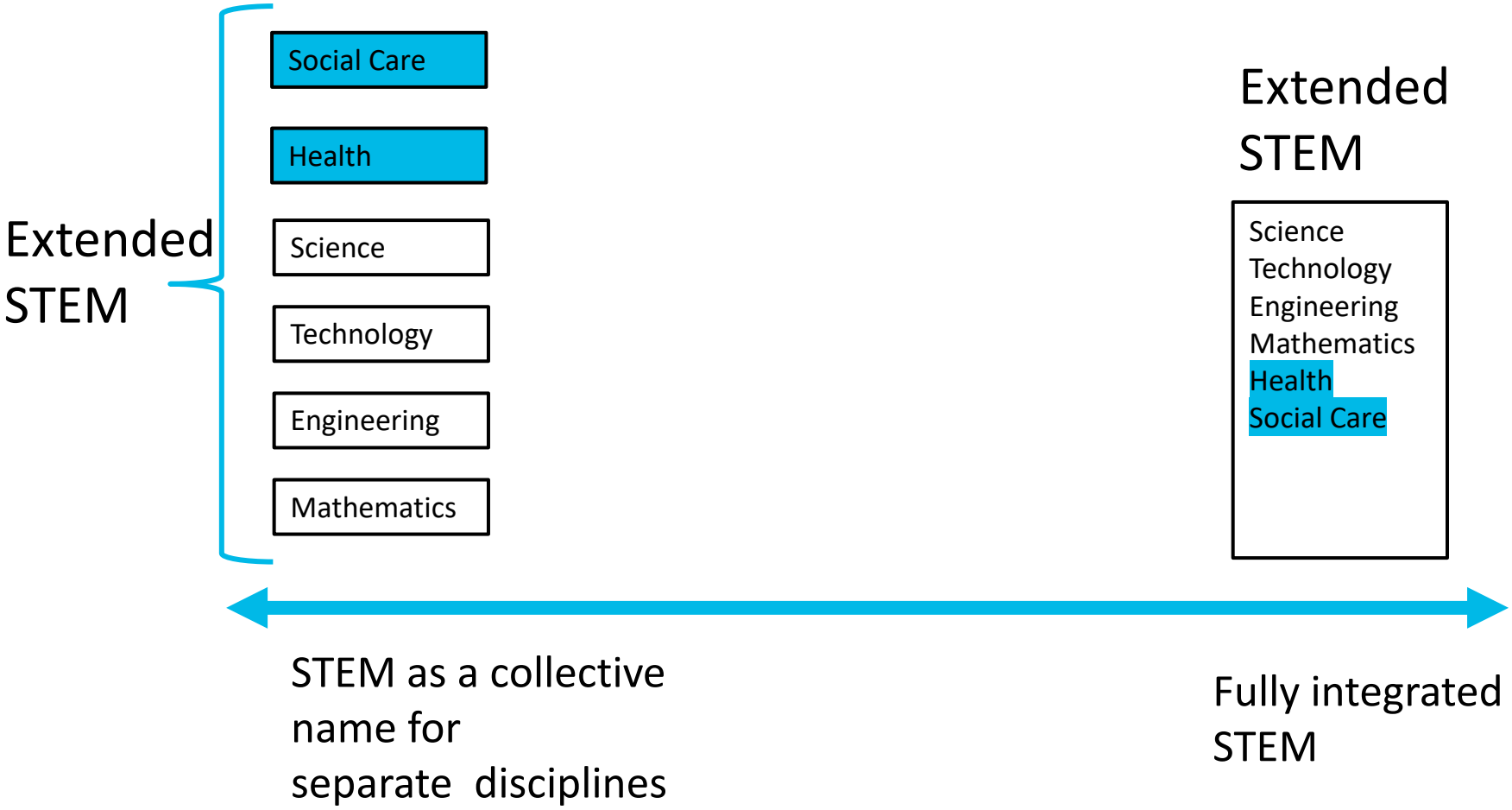
What is STEM? Traditional views



Cross-disciplinary work in the project



Results

- Formally implementing authentic practices remains a challenge, for teachers and students alike.
- A majority of teachers are enthusiastic about real-world relevance in the design projects, however.
- The design projects mostly included technology and engineering content, with some science and mathematics albeit at a lower level.
- Surprisingly, even the technology and engineering content was at a low level.

Conclusions and implications

- If the purpose of integrated STEM is to also develop knowledge in separate disciplines, design projects need to be more closely related to contemporary upper secondary subject content.
- The teachers also need to plan STEM problems with a clear subject focus.
- The design project did succeed in focusing on and unleashing cooperative and creative skills, however.

Conclusions and implications

- The findings thus point to the difficulties involved in integrating all STEM disciplines simultaneously.
- Frame factors also affect the possibility to work in a way that promotes the integration of STEM subjects.
- E.g., the schedule and how subjects and courses are executed.
- If increased STEM integration is sought, then introducing a curriculum that explicitly encourages subject integration would be beneficial.

Conclusions and implications

- Being part of a structured engineering design process is a learning objective in itself.
- The study highlights cooperation and teamwork as being key to achieving any true form of authentic learning.
- Much merit is to be found in “wonderful messy modelling” processes for communicating design ideas.
- However, this also makes assessment harder.

Future research

- It is apparent that most groups learned about the technological design process, but to what extent requires further research.
- Future research could investigate how to put together integrated STEM projects where all subjects include components at the right curricular level.
- Teacher education could train future teachers to integrate whilst also respecting the integrity of each individual STEM subject.

Thank you!

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