



UiO : Institut for pedagogikk
Det utdanningsvitenskapelige fakultet

Computational Thinking, Collaborative Learning, and Tools

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Innhold

- Specific vs. general skills
- Computational Thinking as tool and as subject
- ProSkap project, example from our work
- Design thinking vs. CT
- Mediation in CT

Specific vs. General Skills' Practices

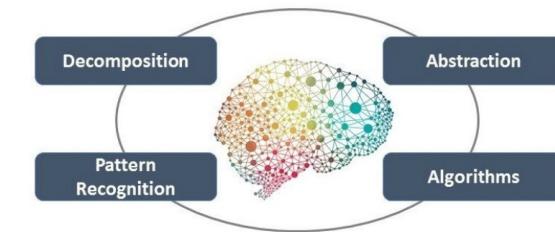
- Should CT be taught as a subject on its own, or should it be integrated with other subjects?
- There is constant “battle” among national curriculum developers to get sufficient time for their subject, which are changing over time according to policy
- Where, how and why should CT people be invited to the curriculum table?
- Nordic countries adopt similar policies

TIMEPLAN									
Klokkeslett	MANDAG		TIRSDAG		ONSDAG (- Sivert)		TORSDAG (- Hilde)		FREDAG (- JB 1130 – 1500)
0830-0900	Frokost m/ tema		Frokost m/ tema		Frokost m/ tema		Frokost m/ tema		Frokost m/ tema
0900-1015	ENGELSK (Lo)	MATTE (B)	KRLE (Lo)	NORSK (B)	M&H (Tore)	NORSK/ UTDANNINGSVALG (KA)	MATTE (B)	SAMFUNN (Sivert)	MATTE (B)
1015-1130	MATTE (B)	ENGELSK (Lo)	NORSK (B)	KRLE (Lo)	M&H (Tore)	NORSK/ UTDANNINGSVALG (KA)	SAMFUNN (Sivert)	MATTE (B)	SAMFUNN (Sivert)
1130-1200	Lunsj		Lunsj		Lunsj		Lunsj		Lunsj *
1200-1300	K & H (Sivert og Hilde)		ENGELSK (Louise)	NATURFAG (Sivert)	M&H (Tore)	LINK/ARBEIDSHEFTE/ BEGREPSLÆRING (B)	VALGFAG (B)	NATURFAG (Sivert)	GYM/AKTIVITET (Sivert + Louise)
1300-1400	K & H (Sivert og Hilde)		NATURFAG (Sivert)	ENGELSK (Louise)	LINK/ARBEIDSHEFTE/ BEGREPSLÆRING (B)		NATURFAG (Sivert)	VALGFAG (B)	GYM/AKTIVITET (Sivert + Louise)

Computational Thinking som Redskab for Problemløsning (kap. 5)



- Man kan skille mellom fysiske og mentale redskaper ift. sosiokulturell teori (Vygotsky, 1978)
- Mentale redskaper er abstrakte (primært begreper) og fysiske redskaper er konkrete (f.eks. håndholdte ting)
- Er CT som redskap primært abstrakt eller konkret, eller en kombinasjon?
- Må man forstå begge sider av CT, og i så fall hva slags relasjon er det mellom det abstrakte og konkrete i CT (gjensidig avhengig, co-evolusjon, årsak-virkning, osv.)?



CT som indholdsdomæne og som redskab i andre fag (kap. 10)

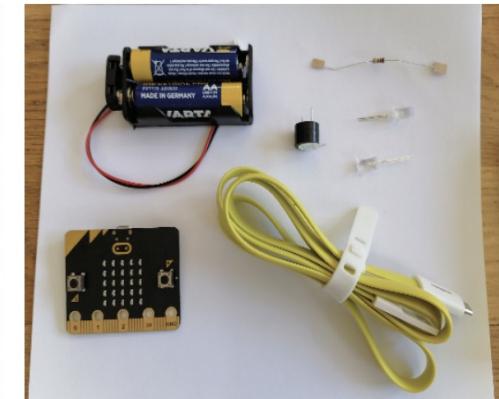
- *Spørsmål som adresseres:* CT kan anvendes i ulike fag, men CT er ikke nødvendigvis det samme i de forskjellige fag? Og kan CT konkretiseres?
- Noen forskere mener CT er en grunnleggende ferdighet (på linje med skriving, lesing, osv.), mens andre mener det er en metode til bruk i andre fag
- F.eks. CT anvendt i diktanalyse , CT anvendt i STEM, ..
- ”CT i rollen som fagligt redskab i læring af indhold inden for eks. el-styring sammenlignet med den rolle, som matematik har i fysik” (s. 350). → *Konkretisering*

Computational Thinking in Collaborative Learning with Digital Tools

- When CT is integrated in other subjects, such as
 - Math, science, music, or arts & crafts (sløjd/håndværk)
- What do the pupils learn about CT in these contexts?
- To what extent does CT work as method to teach and learn domain knowledge?

Programming in a Makerspace (CT i STEM fag gjennom programering)

- ProSkap project in Oslo (UiO + OsloMet)
- RQ: What characterizes block-based programming (MakeCode/Micro:bit) as an explorative design space to teach STEM topics in an online collaborative setting?
 - 43 pupils, 12-15 years old
 - Focus on integrating programming in school subjects: science, math and physics



Methods for Data Collection and Analysis

- Virtual ethnography (Hine, 2000)
 - Screen recordings via zoom
 - Total hours of screen recording: 70
- Participant observation
- Interview via Zoom
 - N=23
- Thematic analysis
- Interaction Analysis
- Visual artifact analysis

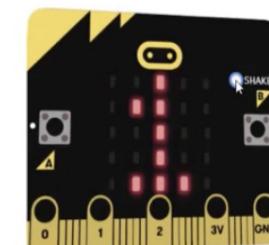
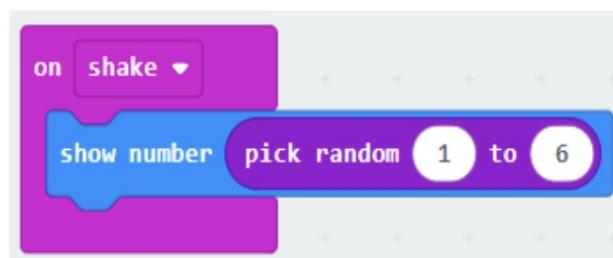
Empirical Data Example

Discursive object →

Technology object →

Table 3. Simulating a die.

Turn	Person	Utterance	Analytic Concepts
1.1	Sophia	It is just like... Can the Microbit be used as a die?	Argumentation base
1.2	Olivia	Nothing more than that?	
1.3	Sophia	No, that is all! ...	
1.4	Olivia	Should we try making a die then, or what?	Negotiation
1.5	Liam	Okay. Mm. We could actually just do what we did earlier.	Example (idea reuse);
1.6	Olivia	Like... On [Microbit] shake... ((pics purple block from pallet)) Then...	Design unit (1)
1.7	Liam	Then you can add “show number”... ((Olivia picks blue block and puts inside the purple block)) and a... In addition, math of course. ((Olivia goes to the math pallet and searches)) Then we have a random number ((Olivia finds the “pick random” block set to default values 0 and 10)) from 1 to 6 or 1 to 10 ((Liam sees the number 10)), but 1 to 6 ((Olivia changes the value from 10 to 6 in the innermost block)). Moreover, this should work like a die.	Rule; Information sharing; Design unit (3)
1.8	Olivia	((Tests Microbit by clicking the “shake” button 5 times)) It works! ((tone of voice is happy))	Design unit (4); Group cognition



Preliminary Results

- Technology objects (means)
- Discursive objects (goal)
- The objects evolve in parallel and interrelate
 - Technology objects evolve by composing design units
 - Discursive objects evolve by merging multiple perspectives (from private to shared understanding)
 - Breakdown, problems, and surprise toggle mode
- We also developed an observation protocol

Design Thinking (kap. 9)

- This is a concept and method that is very similar and to some extent complementary to CT
- What they have in common is e.g.:
 - problem solving (e.g., Schön, 1983; Simon, 1996)
- How they differ is among others:
 - focus on design in DT, and design implies a specific solution
 - premise of AI in computational thinking, which implies generalization and abstraction
- Some authors argue for DT & CT should be integrated to support design and learning (Kelly & Gero, 2021)

Mediation in CT (kap. 11)

- Different methods and tools
 - Physical, digital, analogue, bodily
- Mediation is something CT shares with other (complex) subjects
- What is unique for teaching in CT that makes mediation particularly useful?
- Give some examples from the book

Referanser

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- Schön, D.A. (1983). *The Reflective Practitioner: How Professionals Think in Action*. New York, NY: Basic Books.
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