

CHALLENGES OF TEACHING FOR MATHEMATICAL COMPETENCE: REFLECTIONS INFORMED BY R&D PROJECTS

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TALK AT THE SEMINAR *THE CHALLENGES OF MATHEMATICS TEACHING AND
LEARNING – IN THE US AND DENMARK*

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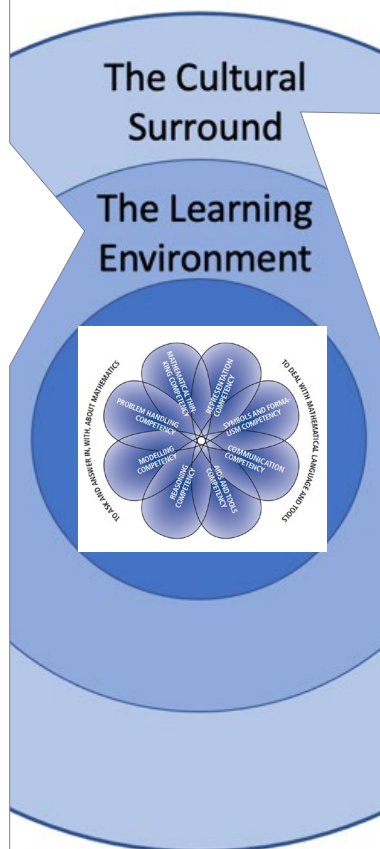
AGENDA

- › Talk by Alan.
- › Groupwise reflection break.
- › Talk by Tomas.
- › Groupwise reflection break.
- › Plenary questions and comments.
- › Wine reception and continued discussions.



THE CONCENTRIC MODEL AND THIS TALK

- 25 years of R&D cooperation with grade 1-12 teachers about planning, organizing, enacting, and assessing competency-oriented mathematics teaching.
- Longitudinally video-observing more than 300 of their lessons (cf. [homepage](#)).



- "Foreign minister" in the KOM Project and subsequent ministerial cooperation.
- Conducting 200+ school-based in-service seminars on competency-oriented mathematics teaching.
- Explicit focus on the cultural surround in the KOMPIS and Ishøj Projects.

(Niss & Jensen, 2002)

WHAT MAKES COMPETENCIES INHERENTLY CHALLENGING TO TEACH AND LEARN?

- › “Competence is someone’s insightful readiness to act in response to the challenges of a given situation.”

- › A complex type of learning ambition.
 - › Must be taught by means of establishing challenging situations for the pupils to act in response to.
 - › Involves knowledge, procedural skills, and a willingness to be the decision making “doer” in such situations.
 - › Each competency needs to be taught repeatedly with variations.

- › Puts pressure on
 - › time.
 - › both the mathematical and the content-didactical competence of the teacher.

THE LEARNING ENVIRONMENT: WHAT DO WE KNOW IS EFFECTIVE?

- › *Framing* by means of competencies as an independent content dimension.
- › *Planning* by means of modules focusing on one competency at a time, repeated consecutively and longitudinally.
- › *Organising* by means of explicitly competency-oriented, student-guided project work.
- › *Teaching* the core of each competency, *supervising* the students in developing it.
- › *Formatively assessing* such project work with an emphasis on the degree of coverage, not the technical level.
- › Constructively and explicitly *aligning* the above.

THE LEARNING ENVIRONMENT: WHAT IS THE DANISH REALITY IN PRACTICE?

- › Competency-oriented mathematics teaching is the exemption, not the rule.
- › But: A large majority of k-9 and vocational teachers and some 10-12 teachers find mathematical competencies sense-making, relevant, and worthwhile to strive for in their teaching.
- › However, they are generally not able to transform that interest into actual teaching practice.

THE CULTURAL SURROUND: SHAPING WHAT IS POSSIBLE IN CLASSROOMS

- › Mathematical competencies are all over the place in Danish k-12 and vocational mathematics curricula.
- › The high stakes exams in Denmark – not least the oral part – invites for competency-oriented summative assessment.
- › Competencies are threatened by syllabusism – in Denmark at high school and university level.
- › Hardly any Danish teachers are sufficiently educated for competency-oriented mathematics teaching.
 - › Teacher education for compulsory schooling (k-9) would like to, but lacks time.
 - › Teacher education for high school (10-12) have time, but suffers from syllabusism.
- › This situation invites for a reform of mathematics teachers education and comprehensive in-service teacher training.

(Højgaard & Winther, 2021; Højgaard, 2023a)

THE ISHØJ PROJECT

- › Developmental project in Ishøj Kommune 2014-2017.
- › All the six k-9 schools in the municipality participated.
- › I was responsible for the mathematics part of the project.
- › The job was to develop the didactical competence of the 50-60 mathematics teachers to carry out competency-oriented mathematics teaching.

(Højgaard & Winther, 2021)

CENTRALE AKTØRER

- › Eleverne.
- › Den enkelte lærer.
- › Fagteamet.
- › Matematikvejlederen.
- › Skoleledelsen.
- › Den kommunale matematikkonsulent.
- › Den kommunale skoleledelse.

UDVIKLINGSPROCESSEN – ET SAMARBEJDS- OG RAMMESÆTNINGSIDEAL

- > **Eleverne** udvikler solide matematikkompetencer, fordi **læreren** er god til meningsfuld kompetenceorienteret matematikundervisning.
- > **Læreren** er god til det, bl.a. fordi **matematikvejlederen og/eller den kommunale konsulent** har undervist i og inspireret til, hvordan man kan gøre.
- > **Læreren** føler sig forberedelses- og evalueringsmæssigt godt hjulpet og støttet, bl.a. fordi **fagteamet** på skolen er et velfungerende fagligt kollektiv omkring den enkeltes udvikling af egen praksis.
- > **Fagteamet** er velfungerende, bl.a. fordi **matematikvejlederen** stiller sig i spidsen for en vejetableret og systematisk vedligeholdt samarbejdskultur baseret på fælles engagement, retning og proces.

- > **Matematikvejlederen** føler sig godt hjulpet og støttet, bl.a. fordi **den kommunale konsulent** stiller sig i spidsen for en veletableret og systematisk vedligeholdt samarbejdskultur blandt kommunens matematikvejledere baseret på fælles engagement, retning og proces.
- > **Matematikvejlederen** lykkes med at stå i spidsen for fælles engagement, retning og proces, bl.a. fordi **skoleledelsen** viser engagement heri og ledelsesmæssigt skaber forventning herom og plads hertil.
- > **Skoleledelsen** lykkes med ledelsesmæssigt at skabe forventning om og plads til et udviklingsorienteret matematiklærermiljø med fælles retning, bl.a. fordi **den kommunale skoleledelse** viser engagement heri og ledelsesmæssigt skaber forventning herom og plads hertil.

UDVIKLINGSMÆSSIGE SNUBLESTEN

- › *Kvalifikationsmæssig problematik*: **Lærere** har svært ved kompetenceorienteret matematikundervisning.
- › *Oplevet snublesten*: **Matematikvejledere** er typisk ikke rustet til at undervise heri.
- › *Mulige udveje*:
 - › Nytænkt indholdsdidaktisk orienteret vejlederuddannelse.
 - › Kommunal matematikkonsulent ansættes mhp. at løfte opgaven.
 - › Ekstern konsulent hyres til opgaven.

UDVIKLINGSMÆSSIGE SNUBLESTEN

- › *Ledelsesmæssig problematik*: Enkelte **lærere** modsætter sig udvikling og fælles retning, og **fagteamet** bliver som følge heraf ikke velfungerende.
- › *Oplevet snublesten*: **Skoleledelsen** tørrer problemet af på **matematikvejlederen**, som dog hverken formelt eller reelt har ledelseskompetence til at håndtere det, og ikke ønsker at få det.
- › *Nødvendig udvej*:
 - › Skoleledelsen påtager sig personaleledelses-problemet og engagerer sig i og giver ressourcer til matematikvejlederens arbejde med at lede fagteamet.

UDVIKLINGSMÆSSIGE SNUBLESTEN

- › *Ressourcemæssig problematik*: Kompetenceudvikling af egen praksis kræver tid og ork til engagement over længere tid med samme fokus, og disse ressourcer oplever mange **lærere og matematikvejledere** ikke de har.
- › *Oplevet snublesten*: **Skoleledelsen** skyder det tidsmæssige problem over til den enkelte, og forstærker problemet ved at ville udvikle i for mange retninger på samme tid, eventuelt på diktat fra **den kommunale skoleledelse**.
- › *Nødvendig udvej*:
 - › Skoleledelsen påtager sig at skabe rum til – og deraf følgende forventning om – udvikling, og støtter aktivt fokus i udviklingsarbejdet.
 - › Den kommunale skoleledelse giver plads til og støtter et sådant fokus.



"Mr. Osborne, may I be excused? My brain is full."

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