



**UiO** : **Faculty of Mathematics and Natural Sciences**  
University of Oslo

# **Centre for Computing in Science Education at the University of Oslo**

Integration of computing to renew basic education

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Vice Dean of Studies



Senter for  
fremragende  
utdanning



**CCSE** Centre for Computing  
in Science Education

# Computing will change society

- Mathematical calculations have always been essential in natural sciences
- Computers permit calculations which were previously impossible to perform
- Big data can be treated, visualized and stored
- Impact on entire society

# Integration of computing will change science education

Natural sciences depends on mathematical problem-solving

Can only solve carefully selected, simple problems using traditional mathematics

Has shaped the *contents* and *form* of the educations

- separated education from relevance

Requires a *redesign of the curriculum*

- opening new pedagogical challenges and opportunities

- Computing allows us to solve practically any problem
- Contents and approaches can be chosen for pedagogical or motivational reasons
- Students can learn robust, powerful methods
- Links research - education
- Builds generic competence

# Faculty vision

**Our aim is for our students to succeed  
academically and professionally**

Life sciences

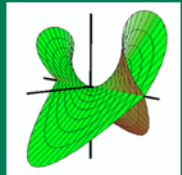
Earth and space sciences

Materials and energy

Enabling technologies



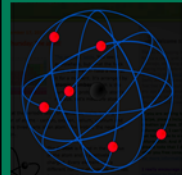
Informatics



Mathematics



Astro-  
physics



Physics



Geo-  
sciences



Chemistry



Pharmacy



Bio-  
sciences



Technology  
systems

● Host ● Partner ● Terminated

	SFF	SFI/FME	Nordic SFF	ERC	Strategic initiatives	SFU	Project w/industry
Life sciences 28%	● ● ● ● ● ●	● ●	●	● ● ● ●	● ● ● ● ●	●	10%
Earth and Space 26%	● ● ● ● ●	● ● ●	● ● ● ● ●	● ● ● ● ● ● ● ●	● ● ● ●		20%
Materials and energy 11%		● ● ● ● ● ●			● ● ●		30%
Enabling technologies 35%	● ● ● ● ●	● ● ● ● ● ●		● ● ● ● ● ●	● ● ● ● ● ●	●	40%

# InterAct

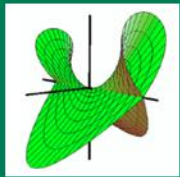
Culture for teaching and learning

Learning environment  
Program development  
Science didactics and school interaction  
Teaching culture

Education management



Informatics



Mathematics



Astro-  
physics



Physics



Geo-  
science



Chemistry



Pharmacy

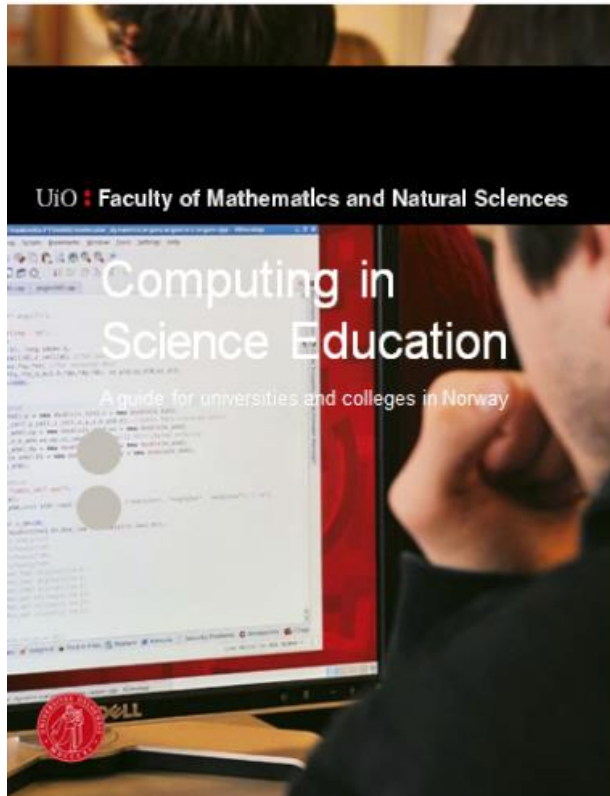


Bio-  
science



Technology  
systems

# Long term initiative



- Established after the Quality Reform 2003
- Implemented in 4/16 Bachelor Programmes
- Annual Faculty CSE-seminars from 2004
- Implemented in Faculty Strategy 2006
- Established as Faculty Brand by the Faculty Board 2013
- Implemented in all Science Bachelor Programmes 2017

## Awards & Funding

UiO's Education Award  
2000 + 2011 + 2012 + 2015

NOKUT's Education Award 2012

Funded 1.25 MNOK from KD 2013

Olav Thon's National Price for Excellent Teaching  
2015 + 2016 + 2017

Olav Thon's support for National Education-related Research Projects  
2015 + 2017

Centre for Excellence in Education by NOKUT 2016

## NOKUT's evaluation of UiO's quality system 2013

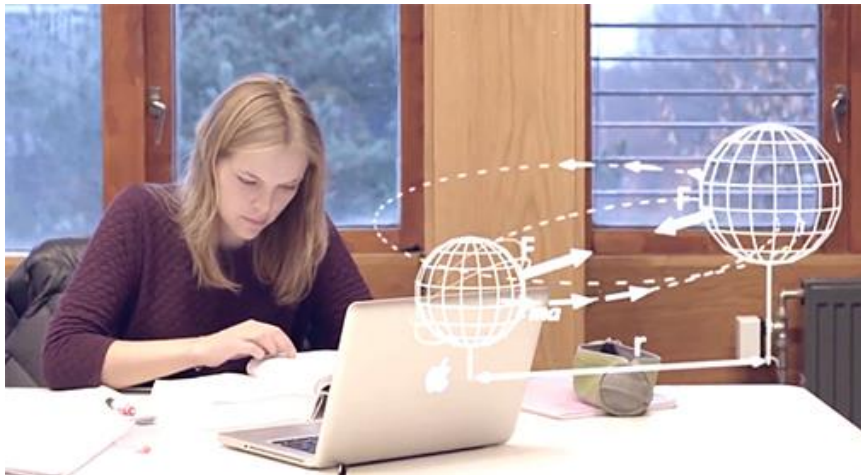
«Fakultetsstyret har i 2013 vedtatt at CSE skal være et **varemerke** for de kandidatene som utdannes ved MN-fakultetet. Komiteen merker seg den dynamikk og endringsvilje som er dokumentert ved dette, og **oppfordrer til videre satsning**. Fakultetet bør også vurdere hva som skal til for å **løfte prosjektet** ytterligere videre fremover.»



# Aims and vision of CCSE

The Centre for Computing in Science Education aims to become an international hub for research-based integration of computational methods in science educations in order to:

- Renew teaching in science and technology - according to needs in research and industry
- Allow students to engage in realistic and research-near problems - at an early stage in the curriculum
- Prepare students for an interdisciplinary workplace
- Form basis for excellent research



<https://dl.dropboxusercontent.com/u/688419/tilSolveig/Computational%20Science%20at%20the%20University%20of%20Oslo.mp4>

# Selection process

Process managed by Vice Dean of Studies

Department Heads involved

Faculty criteria

Administrative support

(i.e. project economist, research support, student administration)

Selected 2 of 3 applications

# Why this process?

The Centre will:

- impact most of the study programmes at the Faculty
- influence Faculty strategic decisions for 5-10 years
- influence economic priorities for 5-10 years

# Success criteria of CCSE

Based on long term, highly awarded, Faculty project

Initiated by excellent scientists (3 SFF)

Collaboration with excellent science didacticians

Fulfils the education strategy

Established as Faculty brand from 2013

Successful student involvement

# Students are engaged in all levels of the educational reform



Inset: PNAS, Photo: Oda Hvrom

Participate in study program development  
Participate in educational research  
Participate in scientific research

Develop material  
(texts, problems, apps, blogs)  
Teach  
Support teaching faculty  
Evaluate

Are strong supporters  
- internally and externally!

# CCSE - research subjects



1. Research-based development of teaching material
2. Research-based development of methods and approaches
3. A culture for teaching and learning
4. Student-driven activities
5. Dissemination, dialogue and communication through partnerships

# Education Centres

The screenshot shows the top navigation bar of the UiO website. On the left, there is a red header with the text "For ansatte" and a search box containing "Søk i For ansatte" and a "Søk" button. On the right, there are links for "Forsiden til Universitetet i Oslo" and "English website". Below the header, there is a main content area with a red background. On the left side of this area, there is a sidebar with a menu icon and the text "Alt innhold". The main content area features a news article titled "Utdanningssentre blir viktige for fakultetet". The article text reads: "Ved MN-fakultetet og UiO får vi etter hvert fire utdanningssentre som blir viktige for vårt arbeid med utdanningskvalitet og læringsmiljø. Ikke minst blir sentrene sentrale aktører i fakultetets arbeid med Meld. St. 16 (2016-2017) «Kvalitetsmeldingens» ambisjoner om fornyede undervisningsmetoder og forskning på vår egen utdanning, økt verdsetting av utdanningsbidraget og merittering av undervisningsinnsats." To the right of the text is a small portrait photo of a woman with blonde hair and glasses. A red stamp in the bottom right corner of the screenshot reads "Newsletter May 2017".

## At the Faculty

- CCSE- Centre for Computing in Science Education
- Norwegian Centre for Science Education
- Competence Centre for Teaching in Science and Technology

## At the University

- Centre for Learning and Education



# Innovations in education

Computing will change science education

- a unique opportunity to renew the curriculum

Computing opens for new pedagogical approaches

- research-inspired and realistic problems
- collaborative, creative and active learning

CCSE will provide the basis to develop, research and disseminate a new curriculum across disciplines