Center for Computing in Science Education

Annual report 2023

CCSE

Center for Computing
in Science Education

Summary

The Center for Computing in Science Education (CCSE) has established itself as international hub for the research-based integration of computing in science education. Computing – using computers to solve problems – has changed research and industry. And the use of digital technologies is expected to impact all of society. However, computing is not yet fully integrated in the contents of educations – neither in the sciences nor in other disciplines. CCSE wants to change that. Computing and programming should be an essential skill in all science educations, and the contents and form of the educations should be changed accordingly. This requires new learning materials and new teaching methods and approaches. These materials and methods should be based on research on how students learn computational modeling and how computational modeling affects learning of the specific discipline.

Education research: Education research at CCSE in 2023 is going through a transition from the first five-year-period to the second period. A new research focus has been established, with a focus shifted towards the impact of AI-based technologies on teaching and learning and as fundamental tool that can change the way we do education research. Three PhD-projects continue and extend the established education research practice at CCSE. PhD-student Andreas Haraldsrud is addressing improved student understanding in chemistry from the integration of computing as well as from new AI-based learning methods. PhD-student Karl Henrik Fredly is addressing student understanding and agency from computational essays, but also addresses impacts of AI technology. Jan Fredrik Olsen started a PhD project at CCSE during a sabbatical at CCSE. He is a professor of mathematics at Lund University, but is broadening his competence in an exciting project to address how computing is impacting student understanding of mathematics. PhD-student Henning V. Myhrehagen is pursuing a PhD project at KURT and CCSE to address how teachers and students integrate computing in the various disciplines at schools. In addition, researchers Hannah Sabo is working on the sAssess project. A further post-doc and a PhD student will be hired in 2024. The group now holds weekly or biweekly group meetings with focus on education research. The focus of the education research program will be on computational literacy, programming in schools, teacher education and in-service training of teachers, and assessment methods to measure to what degree students are building computational skills. A new focus for 2024 will be the impact of AI technologies on student learning and the use of AI technologies in education research.

Culture of teaching and learning: CCSE personnel and KURT has continued to contribute to workshops and meetings focusing on digital teaching and assessments. The CCSE biweekly seminar series continue to focus on issues in teaching and education research. We have also continued to develop, support and expand the Learning Assistants program, which now is growing to become integrated in study programs across the university through a collaboration between KURT and the Center for Teaching and Learning (LINK) at the University of Oslo.

Learning materials and approaches: CCSE has continued to support and develop new learning approaches and new learning materials. The bachelor program in physics has been renewed, with new courses starting fall 2022. Tor Ole Odden has been involved in the design of tutorials used in large-classroom activities hosted in the new active learning classroom (ALC) at the Department of Physics. Similarly, Anders Malthe-Sørenssen has designed new learning activities for the ALC for third semester students. Lex Nederbragt has introduced new assessment methods for school exams using Jupyter notebooks. Andreas Haraldsrud has designed digital learning path and exercises for introductory programming for chemistry

students. All these activities contribute to build a significant portfolio of examples that forms the basis for successful dissemination.

Computational literacy in schools: CCSE and KURT has continued its effort to help teachers prepare for integrating programming in various school courses. From 2020, programming is integrated in mathematics, the sciences, and other subjects at schools. We have continued our effort to train teachers in programming through our nationally recognized brand, ProFag. From 2022, we have also started associated education research activities in collaboration with KURT.

Computational skills for PhD-students: The MSCA Cofund CompSci PhD program started in 2021. The vision is to train a new generation of computationally proficient researchers to renew research and industry across Europe. In total, 31 students have been hired for the program, and we have developed two new courses in advanced computational science and in advanced machine learning and artificial intelligence. The courses have been piloted on two cohorts of CompSci students and will become part of the regular contributed curriculum for PhD students across all disciplines.

Dissemination: CCSE has continued its dissemination efforts both nationally, in collaboration with the University of Southeastern Norway, and internationally through the Circle-U university network and our international partnership for computing in science education, which is a collaboration between the University of Oslo, Michigan State University, Oregon State University and the University of Colorado – Boulder.

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Mission and goals

Vision

CCSE will become an international hub for research-based integration of computational methods in education.

Goals

- Develop research-based learning materials with deep integration of computing
- Develop research-based methods and approaches for integrating computing in curriculums
- Transform student learning and teaching culture
- Engage students through student-driven projects and practices
- Disseminate and adapt practices across disciplines nationally and internationally

Realizing the vision: from the present state to the ten-year goal

Present state (2016)

Existing interdepartmental culture for CSE with some excellent teaching practices and strong student engagement. Math and programming integrated in first semester. Full CSE integration in 2 of 6 basic physic courses and partial integration in other courses. Two textbooks have been published internationally. The research basis for methods and approaches is sparse.

Five-year goals (2021)

The center has initiated a research-based approach to curriculum change and teaching and learning methods in partnership with students. Full integration of CSE in 4 of 6 basic physics courses, with two new textbooks, 2 of 4 math courses, and 1 astronomy course. A pilot extension of CSE into biology; a pilot adaptation by an external partner; a pilot school interaction program; and pilot studies of learning outcomes and teaching methods in 3 courses.

Ten-year goals (2026)

The center is an internationally leading hub for research-based approaches to CSE, with a strong educational research activity and student partnership; Full integration into 6 basic and 2 advanced physics courses, 4 math courses, 4 bioscience courses, 1 course in humanities; Extensions to 3 other disciplines at UiO; Adaptation at 2 external partners. A nationally leading role in the integration of computing in teacher training.

Perspectives on digital competence

Digital competence has become an important skill in society, industry and education. However, what actually constitutes digital competence in often unclear. At the Center for Computing in Science Education we have a clear vision for how to reform education to ensure students are prepared to face tomorrows challenges: We need to integrate the use of computers to solve problems – computing and programming – into all aspects of education across disciplines and across the entire educational ladder. Students need to learn how to work effectively with machines – computers – that are becoming gradually more intelligent. We all need to become literate in the use of computing – to obtain computational literacy. We need to learn to think, argue, analyze and be creative using computing and programming. This does not mean that everyone should become computer scientists. Instead, students should learn to use computers in their disciplinary context.

The focus on digital competence needs to increase in the years to come, in particular with the advent of the new transformer-based language models, such as Gemini or GPT. Students need to be able to use these technologies to become effective workers, but also to understand their advantages and disadvantages. This need was clearly stated in the ministry's white paper on AI in higher education in 2020. CCSE is in a unique position to lead the digital transformation and integration of AI technologies in education because we already have worked twenty years with a vision of how to integrate computing into education. We have experience with how digitization can and will change the content of education, the practice of teaching, and the methods of research. However, developing teaching and assessment methods that teach students to use AI models in effective ways – as tools for their practice as well as to support their learning based on fundamental insights and knowledge of how learning actually is supported – is now becoming a field that needs urgent attention. In particular, a research and evidence-based approach to the integration of AI into educational practices is urgently needed, and CCSE with its combination of education research, evidence-based practices and insights into what practices are important for student learning, is in prime position to take a lead in this field.

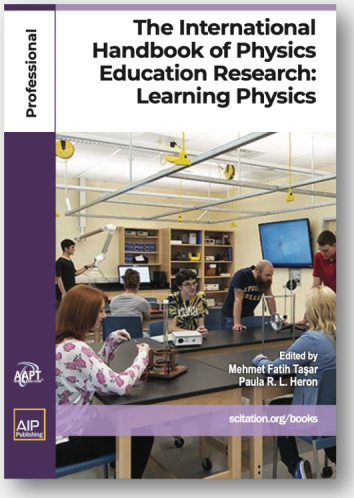
Higher education institutions should provide their students with a research-based education. If all educations integrate computing, this means that a university needs to have research activities and research-based competence in three related fields: (1) In the specific disciplinary field: For example, a bioscience education must build on high quality bioscience research; (2) In the computational field: An education with a computational element must build on a strong research activity in this area; and (3) In education research. Only the largest institutions are able to build top research activities in all these areas and provide high quality, research-based education that integrates the computational and digital perspectives.

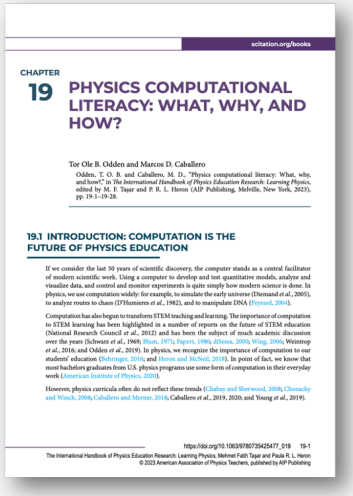
We are convinced that the approach and strategy of CCSE will become more important as more and more stakeholders, institutions and students realize the importance of an up-to-date education with a modernized curriculum. The growing digital divide – between parts of the population that have digital access and master the digital technologies and the rest will only widen. The only realistic solution is to address this challenge through education. We need to include digital skills – deep, non-trivial skills – throughout the education. However, this requires a new generation of teachers and researchers who can build computational curriculums and educate tomorrows teachers. CCSE is taking a leading role in training these researchers and teachers.

Highlights 2023

CCSE research highlight

CCSE researchers Tor Ole Odden and Danny Caballero was invited to publish an overview of computational literacy in the American Association for Physics Teachers Handbook of Physics Education Research. This provides a theoretical foundation and description of the research focus at CCSE and demonstrates CCSE's prominent international position in the field.



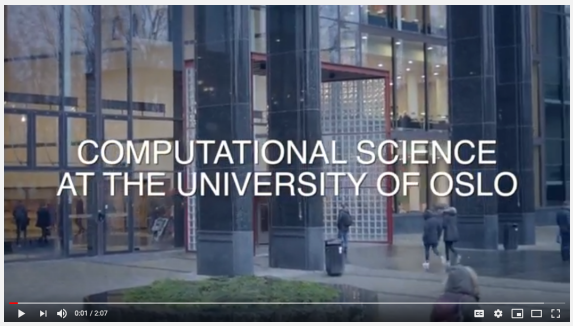


Jerry Feldman visited CCSE as an incoming Fulbright Fellow

We are very excited that Jerry Feldmans from George Washington University decided to spend his sabbatical at CCSE in the fall of 2023. His planned topic for the stay was to investigate and support the use of large-classroom active learning methods at CCSE and in Norway. He has been a great support in consolidating a culture for active learning methods at the University of Oslo and in establishing large-classroom methods for use in newly developed active classrooms that are currently constructured near CCSE's premises.

Illustrative films and podcasts about CCSE and integration of computing

Two films that illustrate how computing is integrated into the bachelor educations at UiO have been published. The target audience is prospective students and the general public.
Film: Computational science at the University of Oslo: https://youtu.be/0vLutIsrgIo (english)
Film: Computational methods in study programs at UiO: https://youtu.be/T6Wa59E7S-Y (norwegian)



Podcast: Research projects for bachelor-students: https://soundcloud.com/nokutpodden/den-om-forskende-bachelorgradsstudenter (norwegian)
Podcast: Bachelor-students who teach: https://soundcloud.com/nokutpodden/den-om-studenter-som-underviser (norwegian)

Plans and Priorities

The main activities of the center from 2022 and onwards follow the action plan for 2022-2026 with four main work packages.

Theme 1: Educational development (2022-2026)

Integration of computing and experimental methods: Experimental data collection and analysis will be integrated into the teaching workflow in introductory courses starting with the first year of the physics bachelor program in 2023. In 2024, particular focus will be placed on developing pedagogies and material for teaching large classes in the Active Learning Classroom (ALC) in the Department of Physics.

Instructional methods: The Learning Assistants program will be extended across the natural sciences and also beyond the natural sciences. Students who develop learning material will be enrolled in the LA program, integrated into the teaching team, and closely supervised by pedagogically experienced faculty. In 2024, we will continue the development of direct instruction methods in introductory courses and project-based methods in advanced courses. In 2024, we will continue to develop and test new learning approaches to student innovation with student teams from the Honours bachelor program in collaboration with the new Center for Interdisciplinary Education – INTED.

Learning material: We will continue development and support of docOnce as an infrastructure for modular learning material, but will consider transitioning to other, more broadly supported tools that are in development internationally; we will build a community for authors through regular meetings, workshops and retreats; and adapt and develop textbooks and digital learning material to various domains in collaboration with domain specialists. New learning material will be developed for use in the active learning classroom in the physics program. These methods and approaches will then be disseminated to other programs that want to develop active learning in large-class situations in a Norwegian context.

Assessment and evaluation: The initial assessments developed for assessing computational thinking in computational essays will be distributed and used in a broader context and in more courses that employ activities that are similar to computational essays. We will also expand on the use of jupyter-notebooks in school exam situations as the use of school exams are expected to increase due to the advances in AI-based tools. We will continue to help reshape student evaluations to be based on research-based principles.

Action	Description	i	ii	i	ii	i	ii	i	ii	i	ii
Theme 0: Management (AMS)		2022		2023		2024		2025		2026	
A0.1	Annual progress reports	D01		D01		D01		D01		D01	
A0.2	Advisory board meeting			M02				M02			
Theme 1: Educational development (LN)		2022		2023		2024		2025		2026	
A1.1	Integration with experiments			M11				D11			
A1.2	Instructional methods										
A1.3	Learning material			M13		M13		M13			
A1.4	Repository					M14		D14			
A1.5	Assessments and evaluations		M15			M15					
Theme 2: Education research (TOO)		2022		2023		2024		2025		2026	
A2.1	Computational literacy (Res)			M21				D21			
A2.2	Computing in math (PhD)			M22				D22			
A2.3	Computing in schools (PhD)			M23		D23					
A2.4	Computing in chemistry (PhD)			M24				D24			

Action	Description	i	ii	i	ii	i	ii	i	ii	i	ii
Theme 3: Culture for teaching and learning (TS)		2022		2023		2024		2025		2026	
A3.1	Workshops and seminars			M31		M31		M31		M31	
A3.2	Summer institutes			M32				M32			
A3.3	Student projects										
A3.4	Teacher courses					M34		M34		M34	
Theme 4: Dissemination (KM)		2022		2023		2024		2025		2026	
A4.1	TraCS PhD training							M41			
A4.2	ProFag					M42		M42		M42	
A4.3	Cross-sector programs							M43			
A4.4	Non-science applications							M44			

M = Milestone, D = Deliverable, Color intensity indicate stages
AMS = A. Malthe-Sørenssen, LN = L. Nederbragt, KM = K. Mørken
TOO = T. O. Odden, TS = T. Skramstad

D01: Annual progress report; M02: Advisory board meetings
M11: Implementation in physics; D11: Learning material published
M13: Textbooks and digital materials published (phys., bio., phys.)
M14: Repository structure assessed; D14: Repository launched
M15: Assessments in intro courses (physics, chemistry)
M21: PER handbook entry; D21 Comp. literacy workshop in Oslo
M22: Midway eval of PhD student; D22: PhD project finished
M23: Midway eval of PhD student; D23 PhD project finished
M24: Midway eval of PhD student; D24 PhD project finished

M31: Annual workshops and bi-weekly invited seminars
M32: Biennial summer institutes (bio, chem., humanities)
M34: Annual pedagogical/computing courses (phys, bio, chem, humanities)
M41: First cohort finished.
M42: Reports on yearly activities in ProFag (teacher courses)
M43: Development of cross-sector program: D43: Launch of cross-sector program
M44: Semi-integration of computing in study programs (philosophy, economics)

Theme 2: Education research (2022-2026)

The education research activity will continue the work initiated in the first period. The center resources will be used to (i) extend studies of computational literacy, design-based studies in physics and the use of assessments, and address student evaluation studies, (ii) initiate studies of the impact of computing in chemistry with PhD-students Andreas Haraldsrud, and (iii) initiate studies of teacher training and professional development and impact of computing in school education with PhD-student Henning Myhrehagen. The research activity will focus more on the development and application of AI-based text processing tools, such as the use of text embedding methods from large language models, in a joint effort between CCSE and INTED – Center for interdisciplinary education. We consider CCSE to be in a unique position to develop an internationally leading research activity in this field. A post-doc and a PhD-student focusing on Natural Language Processing will be hired in 2024. We will host an incoming sabbatical researcher focusing on mathematics education research in 2024.

Theme 3: Culture for teaching and learning (2022-2026)

We will continue with teacher and student activities that have been effective: biannual workshops for teachers and LAs; education seminars at all involved departments; teaching teams in large courses, continue and extend the teacher training initiated by KURT, the Center for teaching and learning in science and technology at the Faculty for mathematics and natural sciences, and consider continuing with Summer Institutes for both internal and external participants. To increase the computational proficiency of the teaching faculty, we will together with KURT develop courses inspired by ProFag for university teachers. However, due to the pandemic, we have postponed summer institutes. Instead, we will focus on developing digital learning progressions and digital portals for university teachers.
Together with KURT, CCSE will continue to develop a common meeting place for students and teachers interested in educational development through talks, workshops, hackathons and social activities. The goal over the coming three-year period is to merge the activities from theme 3 into the regular activities of KURT in order to make the efforts from CCSE into a permanent part of the institution. We will organize bi-weekly meetings at CCSE throughout 2024 focusing on challenges and opportunities in educational development projects and the use of AI in both education research and educational development.

Theme 4: Dissemination (2022-2026)

Dissemination will follow and expand on the activity from the first period. We will build on our success in disseminating practices to bioscience, teacher education, and through select international partnerships. We will widen the focus with an ambition to reach: (i) across levels from 1-13 through BSc, MSc, PhD, and post-graduate education; (ii) across contexts, from science to humanities, social sciences and beyond, (iii) across institutions nationally and internationally; and (iv) across sectors to impact education, research institutes, government, industry, business and startups. We will in 2024 focus on disseminating results on the use AI in teaching and educational development and on the use of text embeddings from large language models for education research.

Theme 1: Educational development

Leader: Lex Nederbragt

Goals (2022-2026)

Develop evidence-based instructional methods, learning materials and assessment and evaluation practices that support the integration of computing in courses and education programs. Hereunder, (1) Develop methods for fully integrated courses that combine theory, computing, experiments and analysis, (2) Initiate integration of statistics, data science and AI, (3) Extend the learning assistants programs, (4) Develop textbooks and interactive and modularized material with integration of computational methods and programming examples; (5) Develop and introduce standardized assessment of computational literacy, assessment methods that integrate computational methods, and evidence-based student assessment tools; (6) Strengthen our efforts to ensure that a diverse range of students have the opportunity to develop computational literacy.

Activities in 2023

Developing fully integrated courses

The bachelor program in physics has been redesigned starting from the fall semester of 2022. The physics students now start with a physics course in the first semester that combines traditional theory, computing and demonstration experiments that are integrated in the learning activities. Classes are taught in the preliminary active learning classroom in the Physics building. Large classroom activities have been developed for students to work together on theoretical, computational and experimental problems in small groups. The new curriculum and teaching practice were updated and improved in 2023 with the help of visiting fellow Jerry Feldman. Subsequent courses in the spring and fall semester also use similar teaching practices. For example, the introductory course in electromagnetism in the third semester has switched to a fully flipped-classroom approach with only student seminars in the large active learning classroom. Student evaluations indicate that students, as expected from education research evidence, find the new learning approaches challenging, but that it changes their learning habits for future semesters and improve learning outcomes.

Textbooks

The center has continued to develop high quality textbooks, interactive learning material and examples and exercises for courses. The textbook on introduction to computational methods in bioscience is used as the basis for teaching in the courses BIOS1100 and is continually developed and improved every year. The textbook in Elementary electromagnetism using Python was used as the main textbook in 2023 and is now accompanied by a full flipped classroom course with small video lectures interspaced by multiple choice and discussion questions and sets of exercises that combines conceptual, theoretical and computational approaches. A textbook on Thermal and statistical physics using Python is under preparation for publication with Springer and was used as the main textbook in 2023. A major effort has been made over several years to develop high-quality textbooks and learning materials in advanced courses, resulting in a set of high-quality books in courses such as Computational Physics, Machine learning and statistical data analysis, Quantum Computing and machine learning, Computational physics 2, Quantum mechanics for many-particle systems, and Advanced machine learning. This material is open access and used in courses at the University of Oslo and internationally. This provides a lasting legacy for the high-quality learning materials developed at CCSE.

Electronic learning material

Several courses with integrated programming have developed digital learning progressions. The learning materials for Computational methods in chemistry was developed and used in 2023 and are being developed into a new textbook. Similarly, learning materials for *Algorithmic thinking for the humanities* and Data-driven projects for honours students are published as open access Jupyter books and were used as the main learning materials in 2023. These projects are unique internationally and contribute to build both legacy and a unique international brand for CCSE.

Learning assistants

The use of learning assistants – students who lead learning activities in smaller groups – have been gradually strengthened and broadened at the University of Oslo and is actively being extended to other institutions nationally and internationally. CCSE is gradually becoming a national hub for the development of learning assistant methods in Norway, and we are contributing to build a Nordic and European learning assistants activity. The use of learning assistants is developed in close collaboration with KURT and with the Center for interdisciplinary education, INTED, which are developing the learning assistant model into a model for interdisciplinary facilitators.

Partnership through Digiwind

CCSE is a partner in the DIGITAL Europe DIGIWIND project coordinated by the Danish Technological University (DTU) with 11 international partners across Europe from universities, research instituted and industry. The goal of the program is to develop new master programs in wind energy that integrates computational competence. CCSE will contribute with expertise on the integration of computing in disciplinary programs and courses and with developing learning approaches and material for advanced courses that will be disseminated to partners in the program. As part of this program, CCSE will continue development of advanced courses in computing and data science and integrate wind energy projects into two master-level courses at the University of Oslo.

Student participation

Students play an important role in the development of learning material. CCSE financed 21 student scholarships in 2023. Teachers and departments can apply for resources that they use to hire a student to develop new learning material that integrates computing in a course. In 2023, these resources were used to develop new learning material for the new first year in the physics program as well as for courses in chemistry and bioscience.

Plans and priorities for 2024

- Extend support to develop learning approaches and activities to be used in the large active learning classrooms and experiment on new methods of instruction that are adapted for the new rooms that will be available from fall 2024.
- Extend use of Jupyter books and Jupyter notebooks to develop interactive learning materials that combine videos, quizzes, examples and runnable computer code.
- Extend the learning assistants program beyond the natural sciences in collaboration with the university-wide center for teaching and learning
- Develop learning materials that are adapted to wind energy application in collaboration with the DIGIWIND initiative.
- Engage students in testing and validation of learning materials

Action plan

Action	Description	2022 i	2022 ii	2023 i	2023 ii	2024 i	2024 ii	2025 i	2025 ii	2026 i	2026 ii
Theme 1: Educational development (LN)											
A1.1	Integration with experiments				M11				D11		
A1.2	Instructional methods										
A1.3	Learning material				M13		M13		M13		
A1.4	Repository						M14		D14		
A1.5	Assessments and evaluations		M15				M15				

M11: Implementation in physics; D11: Learning material published

M13: Textbooks and digital materials published (phys., bio., phys.)

M14: Repository structure assessed; D14: Repository launched

M15: Assessments in intro courses (physics, chemistry)

Comments

A1.1: Experimental integration piloted in Fys1100 and Fys1120 will be continued and extended in 2024.
A1.2: Methods for large active learning classrooms developed and tested.
A1.3: Textbook development is progressing in Fys2160 – Thermal Physics., Fys1120 – Electromagnetism, Programming for chemistry as well as in statistics for computer scientists. A wide range of advanced texts are in development and are used as textbooks in advanced courses such as in Fys3150 and Fys-stk3155.
A1.4: New material is added to the open international repository at compadre.org
A1.5: Assessments for computational literacy have been developed for computational essays and used across two institutions in Norway and the US.

Piloting new assessment methods – Jupyter notebooks on school exams

The introduction of AI based text and code generation tools such as GPT-4 has completely changed how home exams and graded projects can be used as a part of student assessments. GPT-4 typically provides perfect or almost perfect scores in computing and programming tasks in basic programming courses, but also for computational problems for basic courses in mathematics, physics or chemistry. However, an important learning outcome for students in courses with integrated computing, is to solve problems using computational methods and to interpret results from computational models. How can we achieve this in a exam setting, when home exams and graded projects largely are or will be rendered obsolete by AI technology?

In programming classes, it is often sufficient for students to write the code, which can easily be done in an exam setting. When computing is infused in a domain course, students should not only write the code, but also use the code to analyze, discuss and understand a problem. It is therefore important to both implement a computational solution and to analyze and discuss the results from such a solution. This requires computer code to be written and run in an exam setting.

We have solved this by implementing the use of Jupyter notebooks run on a closed Jupyter server during the exam. Students solve exam problems in the form of Jupyter notebooks in a controlled exam situation – physically present in the exam rooms at the university – and hand the problems in in the form of Jupyter notebooks. This has been tested in two courses, BIOS1100 and FYS1120, with success. Students report that this exam form is well aligned with both learning activities and learning outcomes and that the technological solution works well. In FYS1120 this has allowed us to test important aspects of the learning outcomes, such as the students' ability to model a complex physical problem at various levels of complexity and discuss the results in light of their domain understanding.

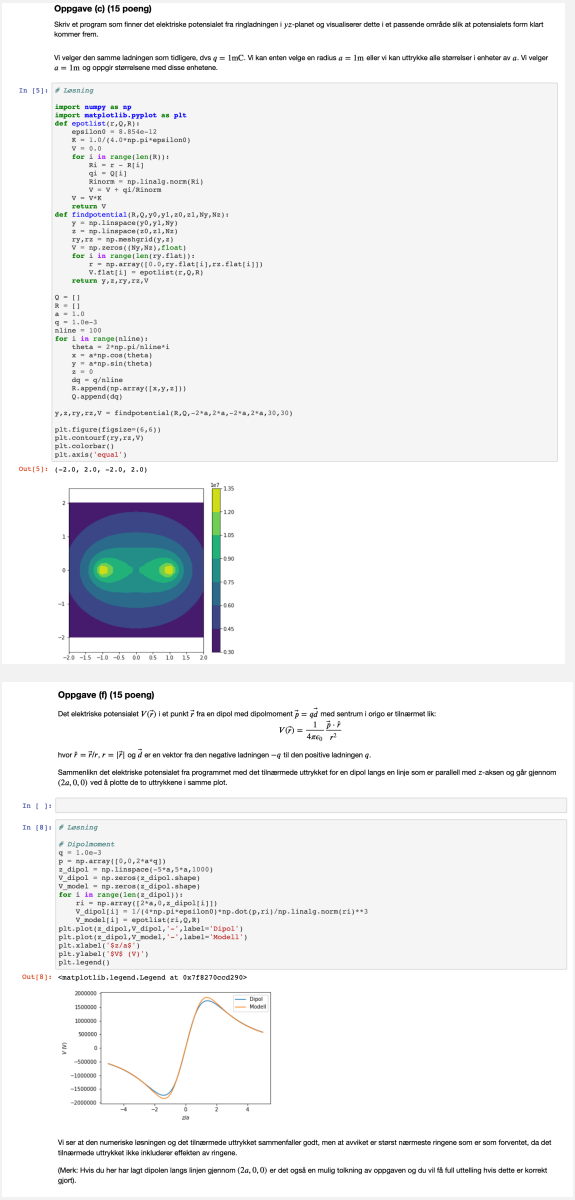


Fig. 1. Illustration of Jupyter notebook problem used during the exam in Fys1120.

Theme 2: Education research

Leader: Tor Ole Odden

Goal (2022-2026)

Develop research-based methods and approaches for the integration of computing in a disciplinary context. Hereunder, (1) extend studies of computational literacy across science disciplines, (2) initiate studies of the impact of computing in mathematics in collaboration with Elise Lockwood at Oregon State University, (3) initiate studies of teacher training and professional development and impact of computing in school education; (4) establish education research studies of the impact of computing in chemistry, and (5) extend the research portfolio through external funding to develop a foundation for computational science education research.

Activities in 2023

Computational literacy in physics

CCSE associate professor Tor Ole Odden and adjust professor Danny Caballero, who has a primary position at Michigan State University, published a chapter on physics computational literacy in the International Handbook of Physics Education Research. This handbook, consisting of three volumes (Teaching, Learning, and Special Topics) is meant to act as a primer on the state of the research in the field for new researchers. The chapter synthesized most of the available research on the subject as of writing (2022) and additionally traced the historical roots of computation in physics education back to the formalization of educational guidelines in the United States in the 1960s. It also theoretically situated the majority of this research into four separate frameworks—modelling, computational thinking, practice perspectives, and computational litearacy—in order to promote the use of learning theories in studies of computation in physics education going forward. In the chapter, UiO is featured as an example of a department that has a deep focus on cultivating physics computational literacy through their educational programs.

Additionally, Caballero and Odden were invited to write a comment article for *Nature* on the subject of how to integrate computation into physics teaching. This article covered some similar topics to the IHPER book chapter, but was directed towards instructors rather than researchers. It has been accepted and is in line to be published in February of 2024.

Research on the University of Oslo Learning Assistant Program

CCSE associate professor Tor Ole Odden, together with Anders Lauvland, associate professor Maria Vetleseter Bøe, and Professor Ellen Karoline Henriksen from the UiO Physics Skolelab, published their first article on the University of Oslo's learning assistant program in the European Journal of Physics. This article examined how the Learning Assistant Model, developed at the University of Colorado-Boulder and widely adopted across the United States, needed to be modified to be implemented in European Higher Education. Through a combination of several research methods—design-based research, interviews with LAs, pre-post surveys, and teaching observations—the research team found that LAs who participated in the first three semesters of the program showed more buy-in to active learning methods as a result of the participation. These results form the basis for a cultural change in higher education, and the success of the program has led to its adoption across the University of Oslo, especially in the Faculties of Law and Education. Additionally, Odden is currently in the process of applying for European Research Council funding to build a European network of learning assistant programs with collaborators in Finland, Sweden, and Germany.

Research on computation in Chemistry, Mathematics, Physics, and pre-college science education

As of autumn, 2023, the CCSE research group consisted of four PhD students and one postdoc, spanning a range of disciplines: PhD students Andreas Haraldsrud (Chemistry Education), Karl-Henrik Fredly (Physics Education), Henning Myhrehagen (Physics/Science Education), Jan-Fredrik Olsen (Mathematics Education), and postdoc Hannah Sabo (Physics Education). The research team had weekly research-group meetings throughout the semester, with regular discussions on the topic of computational literacy across these different disciplines. All researchers are currently working on articles around their respective research projects: Haraldsrud is examining how computation helps chemistry students to connect mathematical and chemical knowledge and make sense of complex chemical phenomena; Fredly is examining the computational skills needed to complete a computational physics masters degree; Myhrehagen is examining teacher uptake of scientific programming after computational thinking became a part of the Norwegian national curriculum in 2020; Olsen is examining how computation is used in mathematics research and education, using the UiO department of mathematics as a case study; and Sabo examined how instructors approached the process of assessing computation in physics education. 2023 saw the first publication from this new cohort of PhD students, with Haraldsrud and Odden's article *From Integrated Rate Laws to Integrating Rate Laws: Computation as a Conceptual Catalyst* published in the Journal of Chemical Education

Research on assessment of computation in physics education

During 2023, Postdoc Hannah Sabo continued her work on understanding how physics instructors approached the task of assessing computational tasks in physics education. This work proceeded in three phases: first, analysis and member-checking of prior interviews with physics faculty conducted by PhD student Sebastian Gregorius Winther-Larsen on their learning goals for computational activities. This analysis revealed a pattern of computational assessment which Sabo named "gentle assessment", and which was presented at the 2023 American Association of Physics Teachers summer meeting and Physics Education Research Conference and is also being drafted for publication in the journal Physical Review Physics Education Research. Second, Sabo collected an overview of assessment approaches and goals, and compiled these into an article currently submitted for publication in the journal The Physics Teacher. Finally, based on these two initial phases, Sabo conducted additional interviews with UiO faculty on their approaches to assessment and active learning with computational methods.

Qualitative analysis at scale through natural language processing

During the autumn of 2023, the CCSE collaborated with a group of three recently-graduated bachelor students—Halvor Tyseng, Jonas Timmann Mjaaland, and Markus Fleten Kreutzer—hired through the INTED SFU, to explore how NLP methods could be used to perform deductive qualitative analysis of educational research at scale. Building on prior NLP work from the CCSE that used topic modeling to inductively analyze large amounts of educational research literature, the group explored how vectorized representations of articles using text embeddings could be deductively used to quantify the rise and fall of different research topics over time, benchmarking results against the prior inductive topic analysis. The results of the study are currently being written up for publication in Physical Review Physics Education Research. The project is also leading to a new direction in the collaboration with Caballero's group at Michigan State University, who are interested in critically exploring applications of this method, and Ben Zwickl's group at Rochester Institute of Technology, who are interested in applying it to their student-level data. In 2024 the CCSE will also hire a postdoc and PhD student (through Odden's start package) who will contribute to this research direction.

Research on Generative AI in science education

Several members of the group have begun to pilot projects on the applications of generative AI to science education, especially related to scientific programming. PhD students Haraldsrud and Fredly have both initiated data sub-projects on this topic, examining how ChatGPT can be used to support problem-solving in Chemistry and computational essays in physics, respectively. Odden has also begun an application for Norwegian Research Council funding to examine how generative AI tools can be used in physics and biology education, in collaboration with members of the BioCEED SFU at the University of Bergen and the physics education research group at Uppsala University in Sweden. The aforementioned PhD student and postdoc hires will likely also have sub-projects related to AI in science education.

Plans and priorities for 2024

- Continue existing studies of computational literacy in physics, chemistry, mathematics, and pre-college science education, with the goal of submitting 1-2 articles from each project in the course of 2024
- Publish existing work on deductive use of NLP methods for qualitative data analysis, and build a collaboration with Michigan State University and Rochester Institute of Technology. Hire PhD student and postdoc to extend and apply the method to other datasets and research problems
- Develop and submit grant proposals to study the effects of generative AI on physics and biology education and build a network of European learning assistant programs which will extending beyond the remaining three-year period of the center
- Hire PhD student and postdoc to work on applications of natural language processing to qualitative data analysis in education and generative AI in science education

Action plan

Action	Description	i	ii	i	ii	i	ii	i	ii	i	ii
Theme 2: Education research (TOO)		2022		2023		2024		2025		2026	
A2.1	Computational literacy (Res)			M21					D21		
A2.2	Computing in math (PhD)			M22					D22		
A2.3	Computing in schools (PhD)		M23				D23				
A2.4	Computing in chemistry (PhD)			M24					D24		

M21: PER handbook entry; D21 Comp. literacy workshop in Oslo

M22: Midway eval of PhD student; D22: PhD project finished

M23: Midway eval of PhD student; D23 PhD project finished

M24: Midway eval of PhD student; D24 PhD project finished

Comments

A2.1: Published high-impact book chapter on computational literacy.
A2.2: Activity started in 2023, but planned in 2022.
A2.3: Project started with new PhD student in 2021/2022.
A2.4: Project ongoing with PhD-student Andreas Haraldsrud. Finished in 2024.

Case: Studying Norwegian Science Teachers' Adoption of Programming after 2020 Curricular Changes (Fagfornyelsen)

In 2020, Norway revised their curriculum documents for upper-secondary science education to include computational thinking (Algoritmisk tenkning) as a cross-cutting theme. Importantly, computational thinking was included on a disciplinary basis, that is integrated into specific disciplines, mainly mathematics and the natural science subjects, rather than being a stand-alone computer science or informatics subject. However, it soon became clear that one of the biggest challenges with implementing these new curriculum documents would be helping teachers get up-to-speed with learning scientific programming, both at a technical and pedagogical level.

Over the past several years, members of KURT and the CCSE have provided training in programming for science teachers through the PROFAG program. Similar efforts have been conducted at other Norwegian universities, like NTNU. However, it is not clear how effective these efforts have been—that is, how comfortable teachers in different science disciplines or subjects feel with computation and programming, how they are using programming in their teaching, and what benefits or challenges they see with the work.

In 2022, the CCSE and KURT jointly hired PhD student Henning Vinjusveen Myhrehagen in order to help answer these questions. Myhrehagen was an excellent fit for the position, having completed his masters in physics education at NTNU and worked both as a physics teacher and a physics textbook writer. Additionally, he had previously collaborated with the UiO Research Section for Physics Education (Skolelaboratoriet) on a research and development project ReleQuant. The project developed online learning resources related to quantum physics and general relativity aimed for year 13 physics classes. The project also researched student motivation, learning processes and conceptual understanding in modern physics.

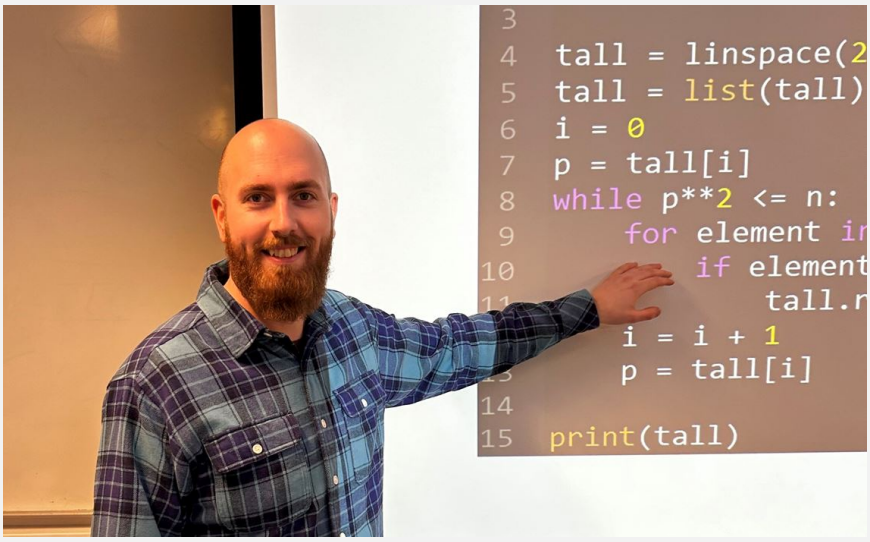


Fig. 2: Henning Myhrehagen teaching programming to teachers.

During the spring of 2023, the last year of implementing the new curriculum documents, Myhrehagen designed an online questionnaire and collected responses from Norwegian science teachers. The aim of this study is to investigate how upper secondary school science teachers experience the implementation of programming. The questionnaire comprises both open-ended and multiple-choice questions. The data collection ended mid-April and resulted in 275 responses.

Analysis of this survey is ongoing; however, initial results show that teachers need continued support to learn scientific programming and how to use it in ways that promote science learning. Many teachers, especially those teaching natural science, chemistry, or biology, have not had the time or opportunity to learn enough scientific programming to become proficient and confident. They regard programming as forced into the curriculum and struggle to see how and why programming should be integrated with their subject. Physics teachers stand out as more proficient and confident with using programming in their teaching. They regard programming as a useful tool to learn more physics than what was possible without programming. Based on all responses, we found that the textbooks are the

teachers' most important source when they plan for programming activities in all subjects, and only a few teachers report that they use programming in inquiry settings.

These results raise some interesting questions about the state of computational adoption among Norwegian science teachers; for example:

- What characterizes a computationally literate teacher?
- Why is programming regarded as easier to integrate with physics than the other science disciplines?
- How is programming represented in textbooks, and how do they affect the ways teachers bring programming to their classrooms?

To dig more into these questions, Myhrehagen conducted follow-up interviews with a selection of science and physics teachers who responded to the questionnaire. He is also planning to collect video data from classrooms in the school year 2024/25 to better understand the knowledge and practices teachers need in order to integrate scientific programming successfully.

Myhrehagen is currently working on his first research article, to be submitted to the journal NORDINA in spring of 2024. He is also planning on presenting his results at the 2024 American Association of Physics Teachers conference, to be held in Boston, MA in July of 2024.

Theme 3: Culture for teaching and learning

Leader: Tone Skramstad

Goal (2022-2026)

Develop a culture for teaching and learning across the science departments. Hereunder, (1) organize biannual workshops for teachers and LAs; (2) organize education seminars at all involved departments; (3) facilitate teaching teams in large courses, (4) continue and extend student educational development project, (5) continue and extend the teacher training initiated by KURT including Summer Institutes for both internal and external participants.

Activities in 2023

Developing teacher culture

The development of a strong teaching and teacher culture is important to improve the quality of the education and eventually also for student learning. Together with, we organize day-long seminars every semester where we focus on teaching and learning, called "Real Utdanning" (aimed mainly at faculty) and "Real undervisning" (aimed mainly at teaching assistants).

Renewing first-year physics education

The bachelor program in physics has been redesigned to integrate computing, experiments with real-time data collection, and statistics so that the complete scientific workflow can be introduced from day one. This is only possible with a simultaneous integration of computing in the experimental data collection and analysis. Three new courses have been developed for the new physics program, one of which will have a significant computational aspect: An introductory course in mechanics in which Tor Ole Odden has played a key role. The new program started in 2022 and have been further refined in 2023. Visiting fellow Jerry Feldman has participated in both teaching and in structuring the first course in mechanics (see box under Theme 1)

Seminars

CCSE is working systematically to build a culture for teaching and learning by establishing meeting-places to exchange experiences on teaching practice and be inspired and informed on education research. In 2023 we arranged the Odd seminars, which are regular seminars organized every odd week with invited national and international speakers that were open for all teaching faculty and students. In addition, we organized a network for introductory programming teachers to share experiences between teachers who are introducing programming to students in various education programs. We also organize a yearly Christmas seminar focusing on Computing in Science Education, which in 2023 again was organized in our own facilities.

Center for Teaching and Learning in Science (KURT)

In order to support the Faculty's activities to promote professional development in teaching, the Faculty has established a Center for Teaching and Learning in Science (KURT). KURT includes participants from all the departments at the Faculty for mathematics and natural sciences. The center aims to be the hub for professional teacher development at the Faculty and is an integral part of the sustainability strategy for CCSE. The activities organized by KURT range from speaking at seminars on the use of student active methods to publishing hands-on tips on teaching on the web-site.

Biannual seminars

KURT organizes biannual seminars for teachers and group teachers. REAL Undervisning is one of several contributions to MN's work on teaching culture. The purpose of REAL Undervisning is to raise awareness among MN educators, including group teachers, about their role, facilitate exchange of experiences across departments and subjects, and inspire good teaching. REAL Undervisning offers an English-language version called "REAL Teaching" the following day. The English-language version has a dedicated section on learning culture at MN. In 2023, the topics have been varied, with a particular focus on feedback competence, use of artificial intelligence in education, and active learning.
In addition, we organize REAL Prat. The goal here is to initiate exchange of experiences and reflection on current educational topics. In 2023, we organized REAL Prat on artificial intelligence and active learning.

Plans and priorities for 2024

- Continue seminar series for teaching staff
- Collaborate with teachers that use and plan to use active learning classrooms
- Continue to provide and improve teaching workshops for learning assistants

Action plan

Action	Description	i	ii	i	ii	i	ii	i	ii	i	ii
Theme 3: Culture for teaching and learning (TS)		2022		2023		2024		2025		2026	
A3.1	Workshops and seminars	M31		M31		M31		M31		M31	
A3.2	Summer institutes		M32				M32				M32
A3.3	Student projects										
A3.4	Teacher courses			M34		M34		M34		M34	

M31: Annual workshops and bi-weekly invited seminars
M32: Biennial summer institutes (bio, chem., humanities)
M34: Annual pedagogical/computing courses (phys, bio, chem, humanities)

Comments

A3.1: Workshops and seminars are listed in the tables at the end of the report.
A3.2: Summer institutes are planned for the period from 2024-2026, but not in 2022.
A3.3: Student projects are listed in the tables at the end of the report.
A3.4: Teacher courses are listed in the tables at the end of the report.

New podcast series in collaboration with KURT

In 2024, KURT launched REAL Læring, KURT's own podcast on teaching and learning in STEMs. A total of 7 episodes were produced. The topic for Season 1 was artificial intelligence in teaching and learning. The first 6 episodes featured guest speakers in the studio, while in episode 7, ChatGPT was given the opportunity to "speak". The podcast is hosted by Vidar Skogvoll from KURT. With study quality funds, we employ a student who assists with editing and production.

Learning assistant program (LA program)

Since the spring of 2023, KURT has been responsible for the "Learning Assistant Program," an educational offering for group teachers at MN. Previously, the program was led by Associate Professor Tor Ole Odden from CCSE. The program is a six-week course where group teachers meet for weekly sessions led by Vidar Skogvoll from KURT. The sessions involve discussions on basic pedagogical learning theory and concrete strategies for building relationships with students and fostering active learning. Group teachers also get to practice what they learn in group sessions with their own students and have the opportunity to discuss academic challenges with other group teachers and the course responsible. The program is based on a model developed at the University of Colorado Boulder in 2001, and research has shown that this model has a positive impact on learning and completion, as well as providing valuable experiences for group teachers to carry forward in their careers. Upon completion of the course, group teachers are certified as "Learning Assistants," who are student group teachers with pedagogical training.

Site Visit

CCSE received its midterm site visit in 2023, when Michael Caspersen from IT vest and Aarhus University visited CCSE. The full day program provided CCSE with important feedback on its work and continued to lay a foundation for a long-term collaboration with IT vest and Aarhus University.

Fig. 3: Site visit. From left: Michael Caspersen, Anders Malthe-Sørenssen, Ruth Buø, Linda Lien

A Beacon of Educational Excellence

The Faculty of Mathematics and Natural Sciences (MN) at the University of Oslo is renowned for integrating a robust educational focus. This is most notably reflected in the host of meritorious educators within our ranks, such as Professor Knut M. Mørken's 2024 NOKUT Honorary Award, and esteemed faculty like Lex Nederbragt, Andreas Haraldsrud, Tone Fredsvik Gregers, Anders Malthe-Sørenssen, and Morten Hjorth-Jenssen, all from CCSE/KURT, and Dag Dysthe and Omid Mirmotahari from the MN faculty —testaments to our shared dedication to cultivating a rich educational environment.

Since 2017, the faculty has embarked on a remarkable journey to restructure all bachelor's programs, weaving computational thinking deeply into the curriculum at all academic tiers, including the Ph.D. level. Active learning and education research form the pillars of this systematic transformation, which not only revolutionizes the way we teach but also ensures our faculty maintains relevance in the ever-evolving educational landscape.

Fig. 4: Picture from the ceremony for new excellent teaching practitioners (ETP), 2023. From left: Lex Nederbragt (ETP, 2023), Knut Mørken (Dean of Studies), Tone Fredsvik Gregers (ETP 2022 and leader of Pedagical Academy, UiO), Andreas Haraldsrud (ETP, 2023).

This educational renaissance has stemmed from a dynamic collaboration between a steadfast administration and an innovative teaching staff, with strategic and operational efforts acknowledging the significance of both top-down and bottom-up influences. Together, they have succeeded in maintaining high educational standards, which has paved the way for prestigious recognitions both internally and externally.

A testament to our commitment to excellence in education is the establishment of two Centres for Excellence in Education: the Center for Computing in Science Education (CCSE - 2016-2026) and the Center for Interdisciplinary Studies in Education (INTED – 2023-2027), both with professor Anders Malthe-Sørenssen as a director.

Theme 4: Dissemination

Leader: Knut Mørken

Goals (2022-2026)

Develop and apply a research-based approach to dissemination locally, nationally and internationally. Hereunder, we aim to reach (i) across levels from 1-13 through BSc, MSc, PhD, and post-graduate education; (ii) across contexts, from science to humanities, social sciences and beyond, (iii) across institutions nationally and internationally; and (iv) across sectors to impact education, research institutes, government, industry, business and startups.

Activities in 2023

Partnership through Digiwind

In 2023, CCSE applied for a DIGITAL Europe project together with a team of 11 institutions across Europe. The application was headed by DTU. The goal is to build educational programs that help students in the areas of wind energy systems build robust digital and technical skills. CCSE will contribute with expertise related to integrating scientific computing into STEM education programs and help with the development of targeted modules for masters-level courses, as well as contributing to educational research and evaluation of these courses.

Cross-sector dissemination and innovation

CCSE initiated a cross-sector dissemination project in collaboration with Young Entrepreneurship Oslo and the TechWell Gemini center for humane technology connecting the University of Oslo and SINTEF. The project introduced students to innovation practices and motivated them the develop entrepreneurial solutions to address societal problems by applying computational and entrepreneurial skills.

Research visit by Martina Caramaschi, PhD student at University of Bologna, Italy

During the 3-month period of April-June, 2023, CCSE hosted PhD student Martina Caramaschi, a physics education researcher from the University of Bologna who is studying how methods from machine learning and natural language processing can contribute to research on STEM teaching and learning. During her visit, she learned the natural language processing approach that Odden and Marin had developed to do inductive literature reviews of physics and science education research literatures at scale. She also took part in weekly research group meetings and presented her work at an internal seminar.

Fulbright visit by Physics Professor Gerald Feldman (George Washington University)

During the fall semester of 2023, CCSE hosted visiting professor Gerald Feldman, from the physics department at George Washington University, who had a Fulbright fellowship to help UiO improve its use of active learning methods and also learn how to incorporate computational methods into his own teaching (see box).

Teacher education

In order to disseminate our practices widely, we work to disseminate practices to schools and school teachers. In particular, we are working to establish sustainable dissemination practices to reach the large number of teachers that need to update their computational skills and didactic competence to integrate the use of computing across school subjects.

Plans and priorities for 2024

- Confirm CCSE's position as a national and international hub for the integration of computing in education through national and international partnerships
- Continue extension beyond the sciences at UiO and through Circle-U and Digiwind
- Contribute as partner in EU programs to disseminate practices widely across Europe

Action plan

Action	Description	i	ii	i	ii	i	ii	i	ii	i	ii
Theme 4: Dissemination (KM)		2022		2023		2024		2025		2026	
A4.1	TraCS PhD training							M41			
A4.2	ProFag			M42		M42		M42		M42	
A4.3	Cross-sector programs					M43				D43	
A4.4	Non-science applications					M44				M44	

M41: First cohort finished.

M42: Reports on yearly activities in ProFag (teacher courses)

M43: Development of cross-sector program: D43: Launch of cross-sector program

M44: Semi-integration of computing in study programs (philosophy, economics)

Comments

A4.1: The first cohort of CompSci PhD-students will enter secondments at cross-sector partners in 2023, forming a basis for collaborations with partners and stakeholders from other sectors

A4.2: We will continue dissemination through our professional development programs for teachers

A4.3: Cross-sector collaborations will be strengthened through entrepreneurship programs for students

A4.4: Extension to non-science subjects will be pursued partnership through summer student projects and student entrepreneurship opportunities.

Bringing American active learning pedagogy to Norwegian Higher Education: Gerald Feldman's Fulbright residency at CCSE

During the fall semester of 2023, CCSE was honored to host physics professor Gerald Feldman, from George Washington University in the United States, who spent his sabbatical with us as a Fulbright scholar. Feldman, the former Chair of Education for the American Physical Society (APS), is an expert in the research-based active learning pedagogy SCALE-UP, which has been successfully used in physics instruction for over two decades. He originally met Tor Ole Odden at the 2022 APS April meeting, and the two hatched a plan for Feldman to apply for a Fulbright scholarship to visit the CCSE, learn about our use of computational methods in physics education, and support the educational development at UiO based on his extensive pedagogical experience. After an initial visit in the fall of 2022 the application was successful, and Feldman arrived in Oslo in August of 2023.

During his stay, Feldman primarily focused his efforts on the introductory mechanics and modeling course in the physics department, FYS1100. This course had already undergone extensive revision the prior year to incorporate modern, active-learning based pedagogy. As of fall 2023, it included one 2-hour lecture section each week, one 2-hour large-group "seminar" (a combination discussion and problem-solving session), and small-group problem-solving sessions led by a learning assistant. Feldman attended lectures and participated as a visiting instructor in all seminar sessions, providing enthusiastic discussions and explanations as students worked through physics problems. He also brought small tangible demonstrations and activities that the students could use to explore the physics phenomena they were learning, like testing reaction time by dropping a ruler or rolling different cylindrical objects down a ramp to investigate the effect of moments of inertia. Feldman additionally attended all course planning sessions, providing feedback to the instructors, and organized both extra help sessions for the students (which were enthusiastically attended) and helped design mid-term exams, final exams, and preparatory quizzes.

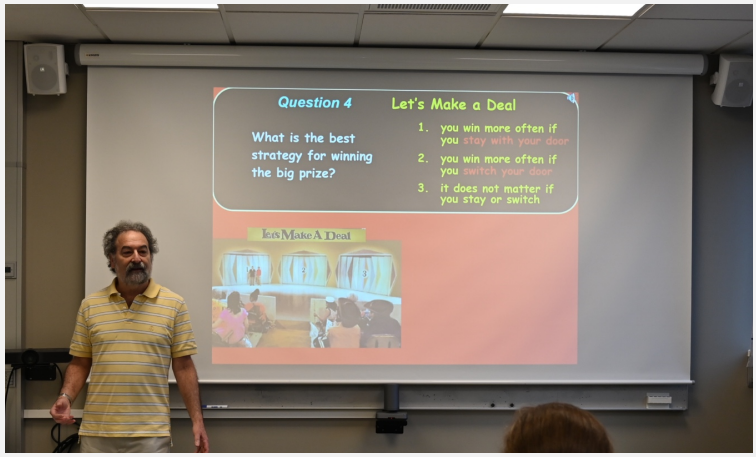


Fig. 5: Feldman demonstrating Scale-Up teaching.

During the CCSE Christmas seminar, Feldman presented his reflections on the semester. In addition to pointing out highlights of the pedagogical design, he provided several points of concrete feedback on how the UiO physics department can continue to improve their pedagogy, such as A) having more regular formative assessment, B) including more structure in seminar sessions, and C) expanding seminar sessions to all physics courses taught at the department. These suggestions were well-received, and the current instructor of FYS1100 (supported by Odden) is working to implement them in the spring version of the course. Feldman also reported receiving a great deal of positive feedback from students, including some personally-written letters thanking him for his support and instruction.

Feldman also took part in other CCSE activities, such as attending weekly research group meetings (presenting twice over the course of the semester), weekly physics education lunches, bi-weekly ODD seminars, meeting with visiting guests, and engaging members of the research group in regular discussions around pedagogy. Part of his Fulbright plan had been to learn about how to use computational methods in his own teaching, and he leveraged his experiences from both the FYS1100 course and the discussions with CCSE staff and researchers gain experience in computational physics education. As an unexpected bonus, many of these discussions focused on the role of generative AI

(ChatGPT) in physics teaching and learning, so Feldman had the opportunity to gain experience with these cutting-edge tools and methods.

As part of his Fulbright plan, Feldman also visited several other major Norwegian Universities to run professional development workshops for STEM faculty and staff based on the SCALE-UP pedagogy. These included University of Bergen, NTNU, University of Tromsø, and University of Stavanger. Turnout and engagement for these seminars was high, with over 50 participants signed up for the session at University of Stavanger. Near the end of his visit Feldman ran the workshop for the UiO physics department, where it was very well received, especially among physics faculty. Feldman will briefly return to the CCSE in February of 2024 for a final check-in with the FYS1100 course instructors to help them implement the suggestions he made at the Christmas seminar.

Report from the CSE activity at USN

Marius Lysaker and Randi T. Holta, USN

Python is the preferred tool in the sciences at USN/TNM. In the first semester, students get a general introduction to programming through the subject "Programming for computing". In the second semester they follow Mathematics 1 and Physics, where Python now forms an integral part of the subjects. This is followed by Mathematics 2 in the third semester and statistics in the fourth semester.

During 2023, USN/TNM has conducted an initiative to enhance the employees' competence in Python programming. The purpose of this initiative is to facilitate the inclusion of programming and algorithmic thinking among employees in subjects beyond the natural sciences. Employees have been given the opportunity to participate in the course *PY1010 - Python Programming for Natural Sciences*. The course commenced in October 2023 and will continue until April 2024. Approximately 10 USN employees and 10 upper secondary school teachers (VGS-lærere) are taking advantage of this study offering. Participants in the course invest a significant amount of personal effort. As an indication: USN's standard for study effort is 27 hours per credit. Therefore, subjects comprising 5 credits require 27*5 = 135 hours of work per participant.

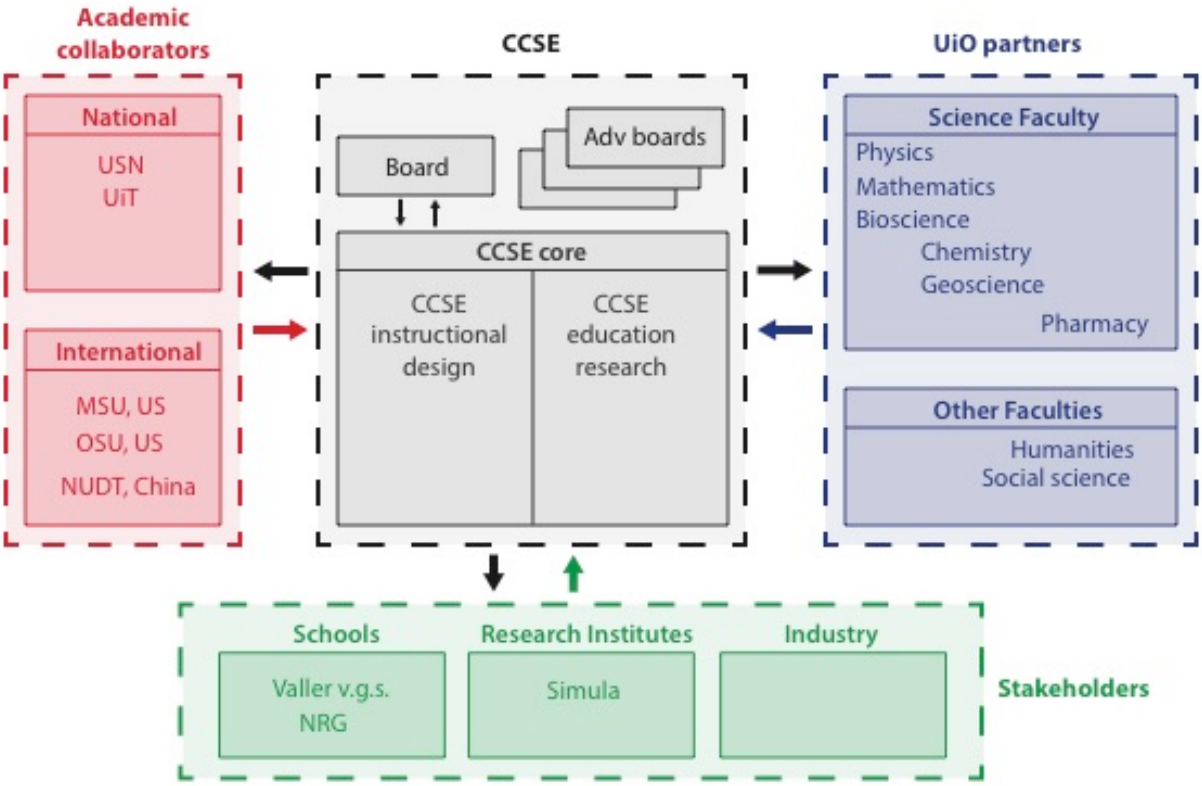
Here is an overview of various activities carried out at USN:

- The course PY1010 - Python Programming for Natural Sciences is conducted for USN employees and upper secondary school teachers.
- Lecture at the conference organized by UHR: Characteristics and Indicators of High-Quality International Engineering Education, Gardermoen, February 2-3, 2023.
- To promote active study learning, USN has launched the "Onboarding Learning Alliance (OLA)". In the autumn of 2023, we incorporated the OLA scheme into the subject IB1020 Python for Computing. The methodology mainly involves structured study groups, collaborative learning, and academic activation (Active Learning). Many students have utilized the scheme, and the feedback has been very positive.
- Further development of teaching materials: a new edition of the textbook Python for Natural Sciences. A large supplement of practice exercises has been included based on student feedback. The textbook receives good feedback from students.
- Restructuring of the subject IB1020 Python for Computing. This 5-credit subject was previously taught intensively over half a semester, with an exam in October. We have now restructured the course plan for all first-year engineering students so that this subject now extends over the entire semester. We have received very positive feedback from students regarding this new arrangement, and the subject matter now matures more over time.
- We have chosen to continue the pilot from 2022 with a separate mandatory meeting for all student assistants associated with the subject IB1020 Python for Computing, Campus Porsgrunn. The meeting includes both academic and social content. We have received very positive feedback on this activity and aim to introduce such a meeting on a permanent basis.

Furthermore, employees from USN have been represented at a number of CCSE events throughout the year: (i) Biweekly odd seminars; (ii) Panel debate – challenges and opportunities with integrating computing in the disciplines, HKdir, November 11-12; (iii) CCSE's Christmas seminar on December 13.

Organization and management

CCSE is directed by Professor Anders Malthe-Sørenssen and supported by an administrative leader, Tone Skramstad. The director is supported by a working group, with an advisory and coordinating function, consisting of the five work-package leaders, the administrative head, director of studies at the Faculty, and a student representative.
The center has a board with representatives from the four main departments, Departments of Physics, Mathematics, Computer Science and Bioscience, a student representative, and two external representatives. The board will have two meetings a year.
The various departments provide contributions to the center in the form of in-kind contributions. For example, the Department of Physics provides a 20% in-kind resource for each of the teachers in the six main courses in physics. This in-kind contribution represents the time teachers use for educational development.
The center has an education research group directed by associate professor Tor Ole Odden and associate professor Marcos D. Caballero. The group has regular group meetings, and organize invited seminars and researcher visits to CCSE.
Additional advisory boards will be established to support the education research activity, evaluation, and input from stakeholders and students.



Personnel

Leadership group

Tone Skramstad ***(administrative head)***.
Tone comes from a position as manager for the Observatory and has extensive experience from administrative positions at the University of Oslo. She is also an author of a book about the history of the Observatory. In CCSE she is in charge of outreach and communications as well as being the head administrative officer

Morten Hjorth-Jensen ***(professor of physics, WP1 leader, 20%)***
Morten is a computational physicist focusing on applied quantum mechanics, quantum computing, and machine learning. He has developed the computational science master program, courses in computational physics (FYS3150) and machine learning (FYS-STK3155). He is a Fellow of the American Physical Society, Member of the Norwegian Academy of Science, winner of the Thon award, and has been awarded UiO's education award 3 times.

Anders Malthe-Sørenssen ***(professor of physics, director CCSE, 35%)***
Anders has extensive cross-disciplinary research, educational and innovation leadership experience. He has developed two master programs, UiO's honours program, courses and textbooks in mechanics, thermal physics, percolation theory, and electromagnetism. He is a member of the Norwegian Academy of Science, winner of the Thon award and winner of UiOs education award 2 times.

Knut Mørken ***(professor of mathematics, WP5 leader, 20%)***
Knut is a founder of CSE and developed and wrote a textbook for the course in numerical calculus (MAT-INF1100). He is the leader of the InterAct project to reform the study programs at the Faculty using a backward-design approach, and the leader of the bachelor program in mathematics. He is the dean of education (2018-2020) and winner of the Thon Award.

Hanne Sølna ***(leader of the study section, MN Faculty, 20%)***
Hanne is the leader of the study section at the Faculty and have been a key driver for the CSE project since 2003. She has broad experience from organizing and developing education transformations and strategy processes. She is also a key driver for the InterAct reform.

Geir Kjetil Sandve ***(associate professor of informatics, 20%)***
Geir Kjetil has a background in statistics and leads a bioinformatics group at the Department of Informatics. He has for several years been responsible for the introductory course in programming for computer science students, IN1000. He introduced Python programming in this course and developed methods to use assessments to systematically improve teaching.

Lex Nederbragt ***(senior lecturer in bioscience, 20%)***
Lex is a Senior Lecturer at the Department of Biosciences, and head of education and training for the Center for Bioinformatics. He leads the implementation of CSE in the bachelor degree at the Department of Biosciences and is responsible for BIOS1100, the introductory course in programming for biology students. He has extensive experience as a Software Carpentry instructor. He leads the Advisory Council for eInfrastructure at UiO.

Education research

Danny Caballero ***(adjunct professor of physics education research, 20%)***
Danny is the Lappan-Phillips Professor of Physics Education, Michigan State University, Leadership Faculty, CREATE for STEM Institute, Michigan State University, and Adjunct Professor at CCSE. He is PI of several large NSF-funded projects on the integration of computing into high-school and university educations. He is *the* leading international researcher on the effects of computational modeling on physics education outcomes.

Tor Ole Odden ***(associate professor in physics education research)***
Tor Ole finished his PhD in Science Education Research at the University of Wisconsin – Madison. The topic of his PhD-research was on sensemaking. He is heading the Learning Assistant project at CCSE, studies computational literacy and the effects of computational essays, and develops a data-driven study of the historical development of education research.

Hannah Sabo ***(researcher, S-ASSESS project)***
Hannah started as a postdoc researcher at CCSE on the S-ASSESS project in 2021. She has been hired in a two-year position from 2022-2023.

Karl Henrik Fredly ***(PhD-student)***
Karl Henrik is a PhD-student from 2022, addressing computational literacy. He has a master degree in Computational Science focusing on education research and computational literacy.

Henning Myhrehagen ***(PhD-student)***
Henning is a PhD-student from 2022, addressing the impact of computational methods and programming on school teacher education programs.

Jan-Fredrik Olsen ***(Visiting senior lecturer / PhD-student)***
Jan-Fredrik Olsen is a senior lecturer at Lund University and have been a visiting CCSE on a sabbatical leave from 2023 to 2024. He has long experience with teaching mathematics at Lund, and is now pursuing a PhD project on the impact of computing on students understanding of mathematical concepts.

Other scientific staff

Andreas Haraldsrud ***(senior lecturer / PhD candidate)***
Andreas has a background as a teacher at Valler high school where he has developed the course "Modellering og programmering X". He is also teaching the introductory course in programming for chemistry students, is teaching in the ProFag contextual programming classes for teachers, and has recently written a textbook on programming for school teachers, as well as several textbooks in chemistry and programming. He is also pursuing a PhD addressing the impact of computing on students understanding of chemistry.

Henrik A. Sveinsson ***(tenure-track post-doc, 20%)***
Henrik has a background in computational physics. He is the project leader for UiO's new honours-program, for which he is also developing and teaching courses in programming for humanists (HON2110) and data-science projects for honours-students (HON2200). He has developed computational content and taught oscillations and waves (FYS2130) and electromagnetism (FYS1120). He is a teacher in the ProFag project and has recently co-authored a textbook in programming for school teachers.

Personnel

Name	Function	Position	Unit
Center personnel			
Anders Malthe-Sørenssen	Center leader	Professor	Physics, UiO
Tone Skramstad	Head of administration	Office manager	CCSE
Knut Mørken	WP leader, 20%	Professor	Math, UiO
Morten Hjorth-Jensen	Course development, 20%	Professor	Physics, UiO
Lex Nederbragt	WP leader, 20%	Senior lecturer	Biosciences, UiO
Geir Kjetil Sandve	Course development	Professor	Informatics, UiO
Hanne Sølna	Administrative mentor	Director of studies	Faculty Adm, UiO
Education research group			
Danny Caballero	Education research (20%)	Adjunct Professor	MSU/CCSE
Tor Ole Odden	Education research	Associate Professor	CCSE
Karl Henrik Fredly	PhD-student		CCSE
Hannah Sabo	Education research	Post-doc	CCSE
Henning V. Myhrehagen	PhD-student		KURT, CCSE
Andreas D. Haraldsrud	Educational devel/research	Lecturer	KURT, CCSE
Jan-Fredrik Olsen	PhD-student/Visiting researcher	Senior lecturer	Lund University
Instructional development			
Øyvind Ryan	Course development, 20%	Ass. Prof.	Math, UiO
Andreas Görgen	Course development, 20%	Professor	Physics, UiO
Dag Kristian Dysthe	Course development, 20%	Professor	Physics, UiO
Henrik Sveinsson	Course development, 10%	PhD-student	Physics, UiO
Mikkel Lepperød	Couse development, 10%	Researcher	Physics / Simula
Anders Hafreager	Couse development, 20%	Ass. Prof.	CCSE, UiO
Student representatives			
Gulla Torvund	Student representative		UiO
Karl Henrik Fredly	Student representative		UiO
Mads Saua Balto	Student representative		UiO
Sander Svartbekk	Student representative, CCSE board		UiO
Anne-Sophie Maria Reber	Substitute student representative, CCSE board		UiO

External projects

Granting body	Project title	Project period	Funding	PI/partners
FinnUT/NRC	Structured assessment method for improved student learning	2018-2023	6000 kkr	PI: Anders Malthe-Sørenssen
EU DIGITAL 2022 SKILLS 03	DIGIWIND	2024-2027	9.662 MEUR	DTU and 9 other partners including CCSE
Intpart/NRC	Bio-inspired Neural Networks for Artificial Intelligence systems: A US-Norway collaboration converging Neuroscience and AI	2020-2025	5709 kkr	PI: Anders Malthe-Sørenssen

Accounting 2023

Budget and Expenditures 2023

NOK - Norwegian kroner	Budget 2022 HK-dir	Actual 2022 – HK-dir	Actual 2022 – UiO	Total
Personnel and indirect costs	4 116 659	3 560 017	4 020 664	7 580 681
Purchase of services	300 000	300 000		300 000
Equipment	200 000	200 000		200 000
Other operating expenses	165 400	326 450	1 140 462	1 466 912
Student projects			1 126 230	1 126 230
SUM	**4 602 059**	**4 386 467**	**6 287 356**	**10 673 823**

List of products

Visitors

Who	Topic	When
Martina Caramaschi, University of Bologna, Italy	Visiting Researcher	March 30-June 30 2023
Ben Zwickl, Rochester Institute of Technology	Visiting Researcher	June 6-10 2023
Tevian Dray , Department of Mathematics, Oregon State University	Visiting Researcher	June 11-14 2023
Gerald (Jerry) Feldman, George Washington University	Visiting Researcher	August 1-December 30 2023
Jan-Fredrik Olsen, Lund University	Visiting Researcher	August 1 2023-July 31 2024
Chong Qi, Department of Physics, Royal Institute of Technology	Visiting Resarcher	September 28-29 2023
Michelle Zandieh, Faculty of Science and Mathematics, Arizona State University	Visiting Researcher	October 9-11 2023
Gerd Kortemeyer, Department of Physics, ETH Zürich	Visiting Researcher	November 7-10 2023
Guillame Schiltz, Department of Physics, ETH Zürich	Visiting Researcher	November 7-10 2023
Elise Lockwood, Mathematics Education at Oregon State University	Visiting Researcher	November 10-17 2023
Lisa Goodhew, Seattle Pacific University	Visiting Resarcher	November 27-30 2023
David Hammer, Tufts University School of Arts and Sciences	CCSE Christmas seminar	December 10-14 2023

Dissemination – external events

The role of CCSE

Topic	where, for whom	who	when
Integrating computational literacy in physic education	University of Bergen	Malthe-Sørenssen	25.05.2023
Integration of computational methods in the curriculum	NTNU	Malthe-Sørenssen	11.12.2023

Contributions to seminars, workshops and conferences

Topic	where, for whom	who	when
Using Computational Essays to Support Student Creativity and Agency in Science	University of Bergen (Invited Talk)	T.O.B. Odden	March 13, 2023
KI I undervisning: ChatGPT and active learning in science	LINK IDEA Seminar: Kunstig intelligens I fremtidens utdanning	T.O.B. Odden	March 21, 2023
Using Computational Essays to Support Student Creativity and Agency in Science	ProDaBi Digital Seminar (Invited Talk)	T.O.B. Odden	April 19, 2023

Integrating Computing into Undergraduate Science Education at University of Oslo: Practice and Research	University of Stavanger (Invited Talk)	T.O.B. Odden	May 26, 2023
Assessment in large classes	OsloMet (Invited talk)	A. Malthe-Sørenssen	June 14, 2023
FRIB-TA Summer School: Practical Uncertainty Quantification and Emulator Development in Nuclear Physics	The Facility for Rare Isotope Beams (FRIB), Michigan State University (MSU) in East Lansing, MI USA	M.H. Jenssen	June 26-28, 2023
Theoretical Frameworks for Computational Physics Education	Poster presentation at AAPT Summer Meeting Physics Education Research Conference	T.O.B. Odden	July 20, 2023
Physics "New" Faculty Workshop	Teaching at European Physical Society Educational workshop, Switzerland	M.H. Jenssen	July 23-27, 2023
Machine Learning and Nuclear Physics, Challenges and Opportunities and educational initiatives	TRIUMF Science week, Vancouver, Canada		July 31-August 4, 2023
ChatGPT, UiOGPT, and AI in Physics Education	University of Oslo Physics Department Seminar	T.O.B. Odden	October 26, 2023
Thirty Years of Education and Research on Nuclear Many-Body Physics at the ECT; from traditional Methods to Quantum Computing and Machine Learning*	European Center for Theoretical Studiers in Nuclear Physics, Trento, Italy	M.H. Jenssen	October 4, 2023
Artificial intelligence and machine learning in physics	Education and Research, Department of Physics and Astronomy colloquium, University of Catania, Italy	M.H. Jenssen	October 14, 2023
Research-based educational practices	Internal seminar, OUS and Semiconductor Physics, UiO	A. Malthe-Sørenssen	November 23, 2023
Research-based educational practices	UiOs utdanningskonferanse 2023	A. Malthe-Sørenssen	November 30, 2023
Active learning, how and why?	UiOs utdanningskonferanse 2023	M.H. Jenssen	November 30, 2023
Intensive course on Machine Learning for Nuclear Physics	University of Caen, France	M.H. Jenssen	Fall semester, 2023
Qualitative Research at Scale with NLP and Embeddings	CCSE Internal Seminar	T.O.B. Odden	December 12, 2023

Workshops and conferences organized by CCSE personell

Topic	Where, for whom	Who	when
ProFag:U	Course for lower secondary school teachers	Haraldsrud, Gregers	10.10.22–20.04.23
ProFag vgs 2	Course for upper secondary school teachers	Haraldsrud, Sand	19.01.23–04.05.23
ProFag vgs 1	Course for upper secondary school teachers	Myhrehagen, Gregers	12.09.23–12.12.23
ProFag:Didactics	Course for upper secondary school teachers	Haraldsrud	05.09.23–05.12.23

Dissemination – internal events

CCSE seminar series

Title	Who	When
IA for education	Gerd Kortemeyer and Guillame Schiltz, ETH Zurich, Switzerland	08.12.2023
Doing physics means feeling confusion	David Hammer, Tufts University School of Arts and Sciences	13.12.2023
An American in Oslo (with apologies to Gene Kelly and Leslie Caron)	Gerald Feldman, George Washington University	13.12.2023
Insights into Assessment Practices in the United States: Unraveling 'Gentle Assessment' in Computational Physics Instruction	Hannah Christine Sabo, University of Oslo	13.12.2023
Teaching Computing into Introductory STEM Courses at Scale	Danny Caballero, Michigan State University / University of Oslo	13.12.2023
Many dimensions - key trends. Using transformer-based text embeddings to perform literary analysis	Markus Fleten Kreutzer, Jonas Timmann Mjaaland, Halvor Tyseng, University of Oslo	13.12.2023
SCALE-UP - Aktiv læringsseminar for MI, FI, KI, astrofysikk, og informatikk	Gerald Feldman, George Washington University	18.12.2023

The bi-weekly ODD seminar series at CCSE

We have in 2023 continued the Open Discussions on Didactics (ODD) seminar series that were established in 2020. The seminars are on Mondays every other week (odd week numbers). It is an informal arena to present and discuss learning theory, educational research and teaching experiences within computational science. To cater to the highly heterogeneous backgrounds and interests of students, teachers and researchers connected to the CCSE environment, we have aimed for highly varied seminars within a broad spectrum of aspects, in a form that invites reflection and discussion.

The series has been well attended, with typically 10-30 attendants per meeting and a good variation in who has attended the different meetings. Seminars have been given both by local researchers in the CCSE environment and external speakers. On demand we offer the possibility to participate via Zoom.

Title	Who	When
What knowledge does pre-service teachers need to teach content-specific programming?	Niklas Karlsen, PhD student, Oslo-Met	30.01.2023
Is the learning assistant of the future a chatbot? A discussion on how artificial intelligence (AI) can enhance personalized learning	Audun Skau Hansen, KURT, UiO	13.02.2023
Lightning-talks: Computation in Physics Education	Henning V. Myhrehagen, PhD student KURT, Karl Henrik Fredly, PhD student CCSE and Hannah Christine Sabo researcher CCSE	27.02.2023
Examining disciplinary differences in computational literacy	Ben Zwickl, Professor, Rochester Institute of Technology	06.03.2023
Interactions between learning activities and motivation in undergraduate physics	Maria Vetleseter Bøe, Associate Professor, Physics UiO	13.03.2023
Developing first-year computer science students' feedback literacy through self-reflection and self-assessment	Omid Mirmotahari, Associate Professor, Informatics UiO	27.03.2023
Expectancy Value approach to physics motivation: The role of recognition as a "physics person" for students' motivation	Anders Lauvland, PhD student Physics, UiO	24.04.2023
Combining numerical methods with introductory mechanics in a first semester course	Joakim Bergli, Professor Physics, UiO	08.05.2023
Computational Fermi problems!	Tor Ole Odden, Associate Professor, CCSE, UiO	22.05.2023

Physics Education Research at the University of Bologna: an overview from the perspective of a PhD student	Martina Caramaschi, PhD student, University of Bologna (Italy)	05.06.2023
Geometric Reasoning as the Bridge between Mathematics and Physics	Tevian Dray, Professor Department of Mathematics, Oregon State University	12.06.2023
A presentation of INTED - Center for Interdiciplinary Education	Anders Malthe-Sørenssen, professor CCSE, UiO	11.09.2023
Methods for Teaching Scientific Programming	Andreas Haraldsrud, lecturer, PhD student, KURT/CCSE, UiO	25.09.2023
Reflections on Curriculum Design Choices and Creating a Digital Game in Linear Algebra	Michelle Zandieh, Pprofessor at the Faculty of Science and Mathematics, Arizona State University	09.10.2023
Enhancing Student Readiness in FYS-1001 Mechanics Through the Readiness Assurance Process	Børge Irgens, PhD student at the Arctic University of Norway	30.11.2023
The LA-Program: Reflections, feedback and (your?) insight	Vidar Skogvoll, Senior Lecturer at KURT – Centre for Teaching and Learning in Science, UiO	06.11.2023
Supporting Desirable Mathematical Practices via Computational Thinking and Activity: A Case of Generalizing in Combinatorics using Python	Elise Lockwood, Professor in Mathematics Education at Oregon State University	13.11.2023
Making a prediction is not necessary to catalyze generative sensemaking	Lisa Goodhew, Assistant professor of physics at Seattle Pacific University	28.11.2023

CCSE educational development activities (policy and teaching)

Topic	Where, for whom	Who	When
REAL education, seminar (Norwegian)	Teachers at Faculty of Mathematics and Natural Sciences, UiO	Gregers, Haraldsrud, Mørken,	17.08.2023
REAL education, seminar (Norwegian)	Teachers at Faculty of Mathematics and Natural Sciences, UiO	Haraldsrud, Mørken, Gregers	19.01.2023
Nettverkssamling i realfaglig programmering	Teachers in schools	Gregers	29.-30.03.2023
Learning Assistant Pedagogical Training		Hansen, Skogvoll	Spring and Fall 2023

Workshops and conferences at CCSE

Topic	Where	Attendance	When
Computing in Science Education Annual Christmas Seminar	CCSE, UiO	60	13.12.2023

Seminars for master students in Computational Science

Topic	Who	Date
Deployment of unsupervised learning in the search for new physics at the LHC with the ATLAS detector	Sakarias Frette, master's student CS: Physics, CCSE	10.03.2023
Transport in the one-dimensional spin-S XXZ-model	João Inácio, master's student CS: Physics, CCSE	29.03.2023
Novel Deep Learning applications on Multi-Phase Flow regimes	Daniel Johan Aarstein, master's student CS: Physics, CCSE	21.04.2023
Predicting Frictional Properties of Graphene Kirigami Using Molecular Dynamics and Neural Networks	Mikkel Jensen, master's student CS: Physics, CCSE	31.05.2023
Application of Supervised Machine Learning to the Search for New Physics in ATLAS	William Hirst, master's student CS: Physics, CCSE	31.05.2023

data: A Study of Ordinary Dense, Parametrized and Ensemble Networks and their Application to High Energy Physics		
SINTEF's Vision and Opportunities: An overview of SINTEF and the exciting opportunities they offer for summer internships and master's theses	Helga Margrete Bodahl Holmestad from the SINTEF Digital's Department of Mathematics and Cybernetics Eirik Høyehem (Helga's summer student) and Mari Lindlan (a former CS student working in the optimization group)	15.09.2023
Innovation in Predictive Maintenance: A dive into a summer project that harnessed machine learning to predict failures in power grid cable terminations. The presentation will highlight their strategic approach to sparse data and the incorporation of explainable methods, specifically SHAP values.	Helga Margrete Bodahl Holmestad from the SINTEF Digital's Department of Mathematics and Cybernetics Eirik Høyehem (Helga's summer student) and Mari Lindlan (a former CS student working in the optimization group)	15.09.2023
Communication Systems, Cryptography, Scientific Computing, Software Engineering and Machine Learning	Joakim Sundnes and Xing Cai from Simula	06.10.2023
Heads up to our first year Masters students, and those who are considering applying to the summer course "BIOS-IN9010 - Computational physiology" in San Diego	Nigar Abbasova, master student University of Oslo	20.10.2023
Former CS: Physics students here at CCSE explained both what they are doing now at DNB and how they got in	Sakarias Frette & Daniel Aarstein	03.11.2023

Student activities

Student activities – student development of learning material

Course and topic	Student	Teacher	When
veileder B-tjenesten	Alessio Maurizio Canclini	Andreas Haraldsrud	15.06.2023-30.06.2024
Python-ekspert undervisningsutvikling MENA3300	Andreas Alstad	Sissel Jørgensen	01.01-30.06.2023
Computational methods for image analysis of two-photono data	Anna Hjertvik Aasen	Frederik Rogge	01.06-01.09.2023
Arbeid på prosjeketet ""Exploring soft and hard constraints in artificial neural networks".	Aslak Hellevik	Vemund Sigmundson Schøyen	25.11.2022-31.05.2023
Innovation project in calm tech - the board - Utvidelse kontrakt	Aslak Hellevik	Anders Malthe-Sørenssen, Tobias Dahl (SINTEF)	01.01-30.06.2023
Computational methods for image analysis of two-photono data	Aslak Hellevik	Vemund Sigmundson Schøyen	01.06-01.09.2023 10.10.2023-29.02.2024
Innovation project in calm tech - the board - Utvidelse kontrakt	Astrid Utheim Aune	Anders Malthe-Sørenssen,	01.01.2023-30.06.2023

		Tobias Dahl (SINTEF)	
Utvikling av materiale til kompendium med integrert numerikk i Fys2160 Termisk fysikk	Benedetta Bruno	Dag Kristian Dysthe	15.08-31.12.2023
Hidden-state Markov models	Carl Fredrik Knutsen	Frederik Rogge	01.06-01.09.2023
Emergent grid cell dynamics in clone-structured cognitive graphs - forlengelse av kontrakt x	Carl Fredrik Knutsen	Frederik Rogge, Anders Malthe-Sørrensen	01.01-30.06.2023
Utviklinger i FSY3120 som følge av Fysikk i første år	Carl Martin Fevang	Are Raklev	26.06-31.08.2023
Veileder B-tjenesten	Catherine Hughes	Andreas Haraldsrud	15.08.2023-30.06.2024
Veileder B-tjenesten	Edvin David Järve	Andreas Haraldsrud	15.08.2023-30.06.2024
Weight-change dynamics in the Chialvo-Bak model	Eirik Salberg Pedersen	Anders Malthe-Sørenssen	20.06-01.09.2023
Programmerings- og modelleringsoppgaver i biologi BIOS1100	Ellen-Beate Tysvær	Lex Nederbragt	15.06-30.11.2023
Forbedrer og utvikler nye programmer til kurset fys-stk3155 og fys-stk4155	Eric Emanuel Reber	Morten Hjorth-Jenssen	01.01-30.06.2023 01.09-31.12.2023
Programmerings- og modelleringsoppgaver i biologi BIOS1100	Even Werner	Lex Nederbragt	15.06-30.11.2023
Forbedrer og utvikler nye programmer til kurset fys-stk3155 og fys-stk4155	Grzegorz Darius Kajda	Morten Hjorth-Jenssen	01.01-30.06.2023
Integrering av elektronisk laboratorieassistent kjm 1101 og å gå gjennom og forbedre ukeoppgaver i KJM1101 - utvidelse kontrakt 00130759	Halvard Grytøyr Strønen	Sissel Jørgensen, Ola Nilsen	19.06-31.12.2023
Veileder B-tjenesten	Hanan Gharayba	Andreas Haraldsrud	15.08-30.06.2023
Veileder B-tjenesten	Hauk Sitre	Andreas Haraldsrud	15.08-30.06.2023
Utvikling av materiale til kompendium med integrert numerikk i Fys2160 Termisk fysikk	Jan Tor Fredrik Stensson	Dag Kristian Dysthe	15.08-31.12.2023

Decoding social information from neuron populations	Jonathan Winsvold	Marianne Fyhn, Anders Malthe-Sørenssen, Torkel Hafting	01.10-31.12.2023
Weight-change dynamics in the Chialvo-Bak model	Julie Natland Bjørnstad	Anders Malthe-Sørenssen	20.06-01.09.2023
Computational analysis of learning in two-photon experiments on mice during an image recognition task	Julie Natland Bjørnstad	Anders Malthe-Sørenssen	01.10-31.12.2023
Dråpe dynamikk relevant for tåkenett	Junmiao Hu	Andreas Carlson	01.01-30.06.2023
Veileder B-tjenesten	Lars Botolv Ekeli Bråtalien	Andreas Haraldsrud	15.08.2023-30.06.2024
Veileder B-tjenesten	Lene Anika Gödde	Andreas Haraldsrud	12.06.2023-30.09.2023
Integrering av elektronisk laboratorieassistent kjm 1101 og å gå gjennom og forbedre ukeoppgaver i KJM1101	Linda Gammelsæter	Ola Nilsen, Sissel Jørgensen	19.06-31.12.2023
Exploring soft and hard constraints in artificial neural networks	Mattis Dalsætra Østby	Vemund Sigmundson Schøyen	25.11.2022-31.05.2023,
Topological measures for navigational problems	Mattis Dalsætra Østby	Vemund Sigmundson Schøyen	01.06-01.09.2023, 10.10.2023-29.02.2024
Utvikling av en modell for robuste i nevrale nettverk basert på Krotov-Hopfield modellen	Mia Merlid	Anders Malthe-Sørenssen	01.01-30.06.2023
Veileder B-tjenesten	Mikhail Zaruykin	Andreas Haraldsrud	15.08.2023-30.06.2024
Utviklinger i FSY3120 som følge av Fysikk i første år	Nils Johannes Mikkelsen	Are Raklev	26.06-31.08.2023
Veileder B-tjenesten	Oskar Ekeid Idland	Andreas Haraldsrud	15.08.2023-30.06.2024
CircuitLab og Python i FYS3220	Pelle Eikeberg	Ørjan Grøttem Martinsen	19.06-31.08.2023
Veileder B-tjenesten	Philip Eskov	Andreas Haraldsrud	15.08.2023-30.06.2024
Programmerings- og modelleringsoppgaver i biologi BIOS1100	Pia Merete Eriksen	Lex Nederbragt	15.06-30.11.2023
Mønsterdannelse i komplekse fluider	Pål Eivind Storvik Olsen	Andreas Carlson	01.01-30.06.2023, 01.09-31.12.2023

Weight-change dynamics and its relation to network geometry in feed-forward networks	Rachel Knutsen Stiansen	Anders Malthe-Sørenssen	15.06-13.08.2023
Programmerings- og modelleringsoppgaver i biologi BIOS1100	Sarah Natalia Andersson	Lex Nederbragt	15.06-30.11.2023
Veileder B-tjenesten	Sylvia Jing Yi Huang	Andreas Haraldsrud	15.08.2023-30.06.2024
Veileder B-tjenesten	Thalia Alex Mecham	Andreas Haraldsrud	15.08.2023-30.06.2024
Teste integrering av elektronisk laboratorieassistent kjm 1101 og teste noen av de nye ukeoppgaver i KJM1101	Tina Kalleson	Sissel Jørgensen, Ola Nilsen	07.08-14.08.2023
Veileder B-tjenesten	Tina Kalleson	Andreas Haraldsrud	15.08.2023-30.06.2024
Videreutvikling av undervisningsmateriale i nevroAI	Vilde Hansteen Ung	Mikkel Lepperød	26.06-31.08.2023
Innovation project in calm tech - the board	Yasmine Kroknes-Gomez	Anders Malthe-Sørenssen, Tobias Dahl (SINTEF)	01.01-30.06.2023

Student activities – student researchers

Theme	Students	Supervisors	When
Use of NLP embeddings methods for deductive qualitative analysis at scale	Halvor Tyseng, Jonas Timmann Mjaaland, and Markus Fleten Kreutzer	Tor Ole Odden	15.06.2023-31.12.2023
Forskningsprosjekt innenfor moderne Hopfield-nettverk og kontinuerlig læring	Simran Sahajpal	Anders Malthe-Sørenssen, Mikkel Lepperød	01.09.2022-30.06.2023

Publications

Scientific publications

- Odden, T. O. B., Lauvland, A., Bøe, M. V., & Henriksen, E. K. (2023). Implementing the learning assistant model in European higher education. European Journal of Physics, 44(3), 035701. https://doi.org/10.1088/1361-6404/acb39e

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