

## Site Visit at CCSE, Centre for Computing in Science Education, 30-31 October 2018

### Strengths and challenges

It was evident from the visit that the CCSE has been productive and successful. The visit was well-organised, with in-depth presentations and discussions on the various activities undertaken and planned by the Centre. The number and quality of CCSE's achievements are wide-ranging and impressive and give a clear indication that the Centre is well-organised and operating effectively. It was also evident that CCSE is well-supported by senior management in the Department, Faculty and more widely; indeed, it is considered a flagship project for the University.

The core mission of the CCSE is to integrate computing into undergraduate science education. A key sign of CCSE's progress in this area is its success beyond physics and astronomy, most notably in biosciences. There has also been some early stage work to introduce computing into disciplines beyond the sciences, in particular law. Obvious challenges are how to maintain this momentum; how to gain traction in other disciplines, especially the sciences; and how to mainstream CCSE's approach. Initial inroads into other disciplines will almost certainly involve identifying 'early adopters', i.e. key individuals with an interest in this area (rather than relying on a 'top-down' approach). This has been the approach taken by the Centre to date, and this has been very effective. But effecting change beyond this is hard. Support and buy-in both from the wider faculty and from senior management will be crucial, and although research evidence will be important it will not be sufficient: teaching enhancements also need to take account of the local context while remaining aligned to the underlying pedagogical principles. Effective teaching reforms also take time to embed. Looking to the future, the Centre's experience and expertise in implementing this type of change may lead to a model that could be rolled out more widely, at Oslo and elsewhere.

The scope of the CCSE's work to integrate computing into high school education has expanded significantly from that in the original proposal as a result of recent changes in the external landscape (the Ministry of Education digitalisation strategy in school education, 2017). The Centre was sufficiently agile to be able to respond to this development by placing greater focus on the professional development of school teachers. To date, this has largely been via in-person training, utilising a 'train the trainer' model. One immediate challenge will be how to achieve wider reach across the school sector. Another challenge will be how to ensure that this activity does not become disjointed from the other work of the Centre, which is focussed exclusively on university-level education. Nevertheless, CCSEs work in this area should place them in a strong position to influence the future direction of travel for the integration of computational skills into the school curriculum.

Students are actively involved in the work of CCSE; this is an important strength. The student presentations during the site visit were much appreciated and gave insight into both the value of students' contributions to the work of the Centre and their commitment to its educational aims. The teaching development projects and the Learning Assistant programme appear to be working very effectively, with students involved at all stages of the design, development and delivery of instructional activities. Students are also involved in computational science research projects. As noted below, the Centre is building expertise in discipline-based education research (in particular physics education research). In the future it would be good to utilise this expertise by offering undergraduate discipline-based educational research projects; not only would this help develop student understanding of the underlying pedagogies, but it could also lead to a future supply of research students.

CCSEs work to establish a computational science education research group is taking shape and their ability to attract staff, students and external funding is an indication of their initial success. Currently the research effort is largely focussed on physics and astronomy, however as the reach of the Centre grows it will be important to expand the research base to other scientific disciplines, and possibly beyond. This may prove challenging as there are unlikely to be many, if any, members of staff already involved discipline-based educational research in other departments. Furthermore, within a single department any research effort is likely to involve very few members of staff, possibly only one, which can be very isolating. However, CCSE is ideally placed to support a critical mass of discipline-based educational researchers across the participating departments by providing a natural home; building a supportive community of practice; and facilitating sharing of ideas and expertise. It is also worth noting that there has been relatively little research to date into the use of computational approaches in the teaching and learning of sciences, so there is a clear (and timely) opportunity for the Centre to make a significant research contribution in this area.

In summary, CCSE has been very successful to date. It has set itself a number of ambitious targets and has made significant progress towards them all. Throughout the visit, there was a strong sense of a supportive ethos and shared vision among a core group of highly committed staff coupled with an effective, people-oriented and participative leadership. Perhaps one of the overarching challenges for the Centre will be how to maintain this rate of progress without spreading itself too thinly or losing focus on its key goals. This will need strategic decision-making, careful planning and a clear vision of what success for CCSE looks like.

### What may other centres learn from this centre?

Some key themes that emerged from the visit that may be helpful for other centres to consider include:

- The importance of strong, people-oriented leadership, a supportive ethos and a core group of committed staff.
- The importance of support from senior management in the department and university more widely.
- The need for a shared vision of what success looks like and what strategic steps need to be taken to achieve this.
- The need for research evidence to support educational enhancements, while recognising that this in itself is not sufficient to embed change more widely, e.g. the local context is critical; and effective change takes time to embed.
- The need to consider how to effect change beyond the Centre's immediate sphere of influence, e.g. through evidence-based educational reforms that can be adapted to the local context; 'train the trainer' approaches; and models for the effective dissemination and mainstreaming of change.