1. Hvilket informasjonsbehov ser dere at lærere, skoleledere og skoleeiere har å vurdere tilstanden og utvikle kvaliteten i skolen?

A quality education system provides all students with the knowledge and the skills they need to succeed in life. In a digital world, knowing how to use information and communication technologies (ICT) and how to program on a computer are proving increasingly important to succeed in life and to participate in society.

For example, there is growing evidence of a positive association between digital competences and favourable labour market outcomes (e.g. type and quality of employment, wages). However, there is also evidence that students from more advantaged backgrounds tend to have a greater exposure to digital technologies and tools, both at school and at home, compared to those from less advantaged backgrounds. It follows that individuals from lower socioeconomic status backgrounds are more likely to end up with lower levels of digital competences. Given that those competences are a fundamental asset in the modern knowledge-based economy these individuals face a higher risk of being excluded from the best jobs, possibly trapped in rapidly disappearing "routine jobs" (Karpiński et al., 2021)[1].
Thus, nowadays the Norwegian education system has the challenge to prepare all our children for the so-called "digital society", regardless of personal or societal circumstances.

In this regard, ICILS aims at measuring 9th grade students' Computer and Information Literacy (CIL) and Computational Thinking (CT) and at relating these learning outcomes with students' background, experience with using computer technologies, and learning about computer technologies. It also investigates the association between students' CIL/CT and the characteristics of the educational context (e.g. teachers' and school leaders' attitudes towards the use of digital technologies, schools' ICT resources and practices).

Computer and Information Literacy (CIL) is defined as *an individual's ability to use computers to investigate, create, and communicate in order to participate effectively at home, at school, in the workplace, and in society.*

Computational Thinking (CT) is the type of thinking used when programming on a computer or developing an application and it is defined as an *individual ability to recognize aspects of real-world problems which are appropriate for computational formulation and to evaluate and develop algorithmic solutions to those problems so that the solutions could be operationalized with a computer.*

(Fraillon et al., 2019)[2]

ICILS will provide valuable information to assess and develop the quality of the education system by answering the following research questions:

- What is the level of CIL and CT among 9th grade students in Norway? How do Norwegian students compare to students in other countries (eg, Denmark, Finland or Sweden)?
- What are the main drivers of students' CIL and CT? Are there gender differences in students' digital competences? What is the association between students' CIL/CT and students' socio-economic background? How can schools reduce the association between CIL/CT and personal or societal circumstances?

[1] Karpiński Z., Di Pietro G. and Biagi F. Computational thinking, socioeconomic gaps, and policy implications. *IEA COMPASS: Briefs in Education* 12 (2021).
[2] Fraillon J., Ainley J., Schulz W., Friedman T. and Duckworth D. *Preparing for life in a digital world. IEA International Computer and Information Literacy Study 2018 International Report*. Springer, 2019.

- What are teachers' and school leaders' attitudes towards the use of digital technologies? What are schools' ICT resources and practices? How do Norwegian teachers and school leaders compare to the ones in other countries?
- What variations do exist in the country in terms of teachers' and school leaders' attitudes towards the use of digital technologies?
- What are the characteristics of the learning environment that are enhancing students' CIL/CT?
- What are the attitudes and knowledge of teachers and school leaders in terms of digital technology?

2. Hvordan vurderer dere at eksisterende prøver, brukerundersøkelser, verktøy og datakilder støtter disse behovene?

ICILS adopts a unique-holistic approach. The study measures and analyse variations in CIL and CT of 9th grade students and collects information about the context in which they develop CIL and CT within and outside the school. In total, ICILS comprises six instruments to be administered in each sampled school/class:

- 3 student instruments

  - An internet browser-based test aiming at assessing students' CIL. Each student is asked to complete two out of 6 30-minutes computer-based assessment modules, which include authentic information literacy, management and communication tasks.
  - An internet browser-based student questionnaire. This 25-minutes questionnaire comprises questions about students' background, their use of computer technology (within and outside schools) and attitudes towards the use of computers.
  - An internet browser-based test aiming at assessing students' CT. Each student is asked to complete two 30 minutes computer-based assessment modules, which include authentic aspects of computer coding, manipulation of data and using computers to solve problems.

The administration of all student instruments takes approximately 3,5 hours, including breaks.

- 3 adult questionnaires
  - A web-based teacher questionnaire asking about teachers' use of computers (within and outside schools), professional learning experience in using computers, challenges when using computers, attitudes to computer use in teaching and their self-reported competency in using computers. The completion of this questionnaire takes about 35 minutes.
  - A web-based ICT coordinator questionnaire asking about the computing infrastructure, technical and pedagogical support provided to teachers for the use of ICT in the school. The completion of this questionnaire takes about 30 minutes.
  - A web-based principal questionnaire asking about the general characteristics of the school (e.g. size and location), the policies (including how they are developed) regarding the use of ICT in school, the perceived value of ICT use for teaching and learning and the extent of teacher participation in teacher development. The completion of this questionnaire takes about 30 minutes.

These instruments, and the holistic approach adopted in ICILS, are well aligned to the research questions listed above and could provide valuable information to assess and develop the quality of the Norwegian education system. The field trial conducted between March and May 2022 not only highlighted the potential of ICILS's instruments, but also identified some weaknesses. In particular:

- The administration of students' instruments takes approximately 3,5 hours and this appeared to be too long. Most of the students performed better on the CIL tasks (at the beginning of the assessment) than on the CT ones (at the end of the assessment). This could be due to multiple causes and, to our opinion, one of them is the so called "fatigue effect": i.e. students perform below their potential because are tired and demotivated when they reach the CT modules. We asked the IEA to introduce some sort of rotation between the CIL and CT test modules (so that some students do the CT tasks at the beginning of the assessment and some others at the end) but this is not possible, given the design of the study.
- The teacher questionnaire developed for ICILS covers a wide array of aspects related to the use of ICTs for educational purposes, especially when compared to the limited number of questions asked in the OCED-TALIS questionnaire. However, the teacher questionnaire developed for ICILS appears to be too long and somehow discouraging. After analysing the field trial results, together with the IEA and the other participating countries, we decided to shorten this questionnaire for the main study to ensure acceptable response rates.

Moreover, due to the design of the study, it is not possible to directly link student test results to the information collected with the teacher questionnaire. Therefore, any analysis relating students' and teachers' data must be conducted at an aggregated level (i.e school level, local level, national level), with some loss of information.

3. Hva vurderer dere som de viktigste styrkene, utfordringene og dilemmaene med kvalitetsvurderingssystemet slik det er i dag?

In our opinion, the first challenge for the NKVS is providing a working definition of "quality in schools". A second challenge, linked to the first one, is identifying a meaningful set of quantitative / qualitative benchmarks and indicators that can be used to monitor the progress of the education system over time.
While dealing with these two challenges, the NKVS must account for the fact that "quality in schools" is a moving target both over time and across levels of education. Thus, the NKVS faces the dilemma of choosing the granularity of the analyses it intends to perform:

- At the system level: this level of analysis relies on definitions, benchmarks and indicators more stable over time, but it is less informative.
- At the sub-system level (barneskole, ungdomsskole, videregående): this level of analysis relies on definitions, benchmarks and indicators that are more sensitive to variations over time and more level-specific, but it is highly informative.

Finally, we would like to express some considerations on the tools used by the NKVS to assess the quality in schools, in particular on the use of international studies.

The great benefit of international studies is to provide standardized data that allows the comparison of different education systems on a wide array of indicators. However:

- the comparison between education systems can bring to misleading conclusions if not complemented by a careful analysis of both contextual information and metadata.
- the number of countries participating in international studies has been growing over time (e.g. in the case of PISA, from 43 to 79 between 2000 and 2018) and tends to include economies with very different traditions, cultures and education systems. For those reasons, the use of international averages as benchmark is less and less meaningful.

- international studies use standardized tools, which – by definition – are less country-specific than the one used in national studies. However, international studies give the possibility to collect a limited number of country specific information via the so called "national options" (i.e. the inclusion country specific questions).