Strategies to include digital formative assessment in the Danish school system

European Schoolnet’s 2019 Study Visit
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Introduction

‘The most powerful single modification that enhances achievement is feedback.’

*John Hattie, University of Melbourne, 1992*

Assessment can guide students in their learning, support their motivation to learn, and improve how teachers teach. It can also serve other purposes, such as certifying student accomplishment, evaluating the output of educational programmes, measuring the performance of educational systems and making comparisons across systems. Summative assessment is particularly suited to such purposes, usually performed at the end of a course or unit, against standardised criteria and often given a grade.

While predominant in most education systems, summative assessment rarely provides students and teachers with feedback that they can use to understand and improve their learning and teaching. In contrast, formative assessment aims to provide students with opportunities to better understand their learning needs and teachers with possibilities to adjust their teaching. Clearly framed within active and personalised learning practices, formative assessment is receiving increased attention from educational policy makers and practitioners.

Digital formative assessment (DFA) in particular has considerable potential to support more powerful student learning, as research evidence suggests ([Assess@Learning literature review](https://www.assessmentliterature.org/), 2019). For instance, it allows for rapid or real-time feedback and scaffolding of next steps for learning at an appropriate level of difficulty. This is true for classroom and potentially for remote or hybrid/blended settings. In practice, DFA is not yet widespread across schools in Europe, but policy makers in different countries are exploring ways of supporting schools to make more use of it (see also [Annex II for an overview of DFA in countries represented by study visit participants](#)).
Interesting examples of DFA implemented in schools and classrooms can be observed in Denmark, rooted in 10 years of pioneering experiences of digital assessment as part of national tests organised at the central level. This report describes a range of DFA practices encountered during a study visit on 26-28 November 2019 in Copenhagen, organised by European Schoolnet in conjunction with the Danish Ministry of Children and Education. This report describes the situation at the time and it is important to highlight that Denmark is currently considering a renewal of their evaluation and assessment system.

The focus of this peer learning visit was to learn from examples in Denmark about strategies to implement DFA practices in schools and, more generally, to discuss the lessons learnt from the country’s pioneering experience of digital assessment. The programme for the 17 visitors comprising policy makers, researchers and teacher trainers from 14 countries1 (see Annex III and IV) included discussions with key actors organised by the Danish Ministry of Children and Education and a visit to the Buddinge school in the municipality Gladsaxe.

Several participants in the study visit were partners in the Assess@Learning policy experimentation, co-funded by the Erasmus+ programme of the European Commission. Assess@Learning has developed an online DFA toolkit for school leaders, teachers, students, parents and policy makers that will be tested in large-scale field trials during the school year 2021-22. Lessons learned from this study visit fed into the development of the toolkit.

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1 Belgium, Croatia, France, Greece, Estonia, Ireland, Italy, Malta, Netherlands, Norway, Poland, Portugal, Spain, Switzerland
1. What is DFA and how does it empower student learning

I would say that DFA is a type of assessment, in digital form, that aids in the adjustment of the teaching, learning and course objectives, through constant feedback gained from both teachers and students through work/activities/tasks carried out during the course of the studies.

Josmar Borg, study visit participant, Malta

While during the visit, Danish stakeholders occasionally referred to the term ‘formative evaluation’, this report uses the term ‘formative assessment’.

DFA includes all features of the digital learning environment that support assessment of student progress and which provide information to be used as feedback to modify the teaching and learning activities in which students are engaged.

Assess@Learning literature review, 2019

This definition highlights the fact that assessment only becomes formative when evidence of learning is actually used by teachers and learners to adapt the next steps in learning. This formative element can be carried out by teachers with the use of rubrics and apps such as ‘Phyz’ (see Annex I) or programs that automate the process and suggest more difficult tasks based on previous answers. During the study visit several inspiring examples of automated feedback were seen, such as

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the Danish national computerised adaptive tests (*see section 3.1*) or EyeJustRead (*see Annex I*).

DFA encompasses a broad range of approaches, tools and learning strategies, such as personalised learning platforms, e-portfolios, digital diaries, social media (blogs, wikis, etc.), digital storytelling, e-textbooks, mobile learning, classroom polling, dashboards and monitoring tools, and digital games. Buddinge school presented an interesting example of a comprehensive formative approach using a personalised learning platform (*see section 5*).

With digital tools, teachers can collect real-time feedback, provide immersive learning environments and support learner choice and learning ‘anytime, anywhere’ (*European Schoolnet perspective paper*, 2019). However, what is at the core of DFA practices is effective timely feedback. Teachers providing feedback to students about their learning, and possibly also students providing feedback on teachers’ instructions can potentially create strong student-teacher relationships.

According to Jens Jørgen Hansen from the University of Southern Denmark Odense, a speaker part of the study visit programme, the research on DFA practices in Denmark focuses on three main questions: How can DFA practices contribute to the quality of teaching and learning? What role does technology play in this process? How do teachers and schools use DFA practices?

As already emphasised, effective feedback is at the core of successful DFA practices. Hansen referred more specifically to feedback that provides diagnostic information about students’ successes and needs, *feed-up* that ensures that students understand the purpose of the assignment (*goal-setting*), and *feed-forward* that guides students on how to progress.

Feedback is crucial for learning because students do not necessarily learn what they are taught and it is in fact hard to predict what they learn. Feedback helps teachers ensure that learning moves the right direction, ensures that everyone is involved, and draws attention to any potential needs of special support. As illustrated in figure 1, there are five key strategies in formative assessment according to Wiliam (2007, 2011). They give active roles to students and their peers and encourage practices such as self-and peer assessment.
Of these five strategies, Hansen laid particular emphasis on activating students as owners of their own learning and the question: How do DFA practices support student agency, hence, activate students as owners of their own learning?

Hansen provided concrete examples in which digital tools enhance formative assessment practices and this led to reflection on how digital tools can enhance formative assessment practices (as summarised in the table below).

![Figure 1: Key strategies of formative assessment (Wiliam)](image)

**Table 1: Examples of use of digital tools for formative assessment**

<table>
<thead>
<tr>
<th>Formative evaluation steps</th>
<th>Digital tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarifying, sharing and understanding learning intentions and criteria for success</td>
<td>Digital tool for communicating intentions and criteria</td>
</tr>
<tr>
<td>Engineering effective classroom discussions, activities, and learning tasks that elicit evidence of learning</td>
<td>Digital learning environment (e-textbooks– e-courses) – ubiquitous opportunity for designing discussions, activities and learning tasks</td>
</tr>
<tr>
<td>Providing feedback that moves learning forward</td>
<td>Digital tool that provides feedback + stores information</td>
</tr>
<tr>
<td>Activating learners as instructional resources for one another</td>
<td>Digital learning community – opportunity for peer feedback</td>
</tr>
<tr>
<td>Activating learners as the owners of their own learning</td>
<td>Personal learning environments, e.g. eportfolio – collection of work and reflections</td>
</tr>
</tbody>
</table>
2. The Danish Policy Context

Denmark’s public school system *(Folkeskole)* is based on trust, local autonomy and horizontal accountability. There are around 1100\(^2\) primary and lower secondary schools *(Folkeskole\(^3\)*), which are owned, governed and financed by Denmark’s 98 municipalities.

Since 2014, a wide-reaching reform of Folkeskole has focused on the following main areas of change: a longer and more varied school day with longer and better teaching and learning, better professional development for teachers, educational leadership, and few and clear objectives as well as simplification of rules and regulations. As basis of this reform, the government set three national goals (OECD, 2016):

1. The Folkeskole must challenge all students to reach their full potential

2. The Folkeskole must lower the significance of social background in academic results

3. Trust in the Folkeskole and student wellbeing must be enhanced through respect for professional knowledge and practice in the Folkeskole.

The context to implement the reform was difficult, as the reform was challenged both by parents and teachers, who were also asked to teach more lessons with less time for lesson preparation.

A clear framework ensures a systematic and continuous evaluation of any steps against the national goals set with the reform. The high degree of local autonomy in the system implies that the central government does not set specific goals for individual municipalities. However, the central government has established mechanisms that make it easier to monitor individual municipalities. This includes

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\(^2\) [https://www.uvm.dk/statistik/grundskolen/personale-og-skoler/antal-grundskoler](https://www.uvm.dk/statistik/grundskolen/personale-og-skoler/antal-grundskoler)

\(^3\) For an overview of the Danish Education System, see: [https://eng.uvm.dk/general-overview/overview-of-the-danish-education-system](https://eng.uvm.dk/general-overview/overview-of-the-danish-education-system)
the development of a data warehouse to which municipalities and schools need to report certain data. The data warehouse includes a wide variety of indicators, such as results from national examinations and assessments, results from surveys on student wellbeing, and transition rates to upper secondary education (OECD, 2016).
3. Digital national tests and tools for formative assessment

Denmark has ten years of pioneering experience with digital assessment as part of national tests. During the study visit, different aspects of national digital tests were presented by Kristian Johnsen and Thorkild Svendsen, both at the National Agency for IT and Learning - the former focusing on summative tests and the latter putting an emphasis on tests for formative purposes. Rasmus Ulsoe Kær, National Agency for Quality and Teaching, presented how national tests and digital tests provided by commercial providers are used by head teachers and teachers for formative purposes.

A survey conducted by the Danish Ministry of Children and Education several years ago of assessment tools and methods in use in the Danish school system found that three types are most used:

- Data from national tests and attendance records, in use in approximately 90% of schools (schools are legally obliged to use this data). Both digital linear and adaptive tests exist, as well as individual student plans.

- Tests from the commercial sector used by schools to supplement national tests. These are mainly subject based tests or diagnostic tests (e.g. ST-test, SL-tests).

- More qualitative methods such as structured observations and artefacts produced by students. Such methods are important to assess for instance student motivation or the ability to work in groups (but are not the focus of this report).
3.1. National computerised adaptive testing

The Danish national tests are a comprehensive and mandatory set of tests for students in public primary and lower secondary schools. Introduced in 2010, their purpose is to inform and support formative assessment of individual students as well as progress towards the goals of school reform. The assumption is that improving teachers’ tools for assessment and feedback will strengthen the evaluation of public schools.

There are ten tests in all, covering Danish, Mathematics, English and Science. Each test consists of three sub-tests, e.g. numbers and algebra, geometry, and statistics and probability in the case of Math. The tests take about 45 minutes to complete and are self-scoring, using an online adaptive programme. A demonstration version of the tests for different subjects is available online (in Danish).

All test questions are closed so that answers can be automatically checked. Figure 2 shows an example (Solve basic equations).

![Solve basic equations](image)

The system has a bank of several thousand items covering almost all of the curriculum, and a minimum of 300 sub-items per sub-test. Test items are designed by subject commissions, tested with 700 students and analysed using the Item Response Theory. Each individual student however only needs to answer a small fraction of these items. Based on previous answers, the student is presented with slightly easier or more difficult test items until the system can place the student with a predefined level of certainty on a proficiency scale. Hence, in adaptive tests, not every student will be tested in all subject topics – as the goal of such tests is
to place students on a proficiency scale in a profile area, rather than testing their knowledge of a specific topic.

Figure 3 shows how student results are displayed, in this case Danish language. The figure shows the proportion of students (clearly) below average (blue), average, and (clearly) above average (green) in the three sub-tests.

**Figure 3: Example display of results of national digital adaptive tests (Danish)**

Figure 4 shows the class progression over time. Students in the green area performed better than in the previous test, and students in the blue area performed worse. The darker the colour, the greater the difference in performance.

**Figure 4: Example display of results of national digital adaptive tests (progression over time)**

Schools can use the test results formatively in different ways.
First, the results can help to monitor the performance of the same group of students over time and help predict their performance at final school leaving exams – as the results of both tests are highly correlated (see figure 5). School leaders and teachers can then decide to provide additional support early on to students who perform below average.

Data predicting the final exams

Second, school management can compare the performance of two different classes at the same grade. Figure 6 shows that the number of low performing students rose from 5 to 13 in one class (left), while it remained low in the other. When such differences became apparent, school management can consider for instance whether teachers and students of both classes receive the same support.

Figure 5: Example display of results of national digital adaptive tests (progression over time)

There are different views on the usefulness of the national adaptive tests. At central level, the results help government see whether particular actions are needed for different municipalities. Teachers generally like the fact that the tests are scalable, auto correcting and adaptive. They also appreciate their high validity since test
results are highly correlated with those of end of year examinations. In addition, they find the summary of the results in relation to the objectives in the national curriculum useful. However, teachers find it difficult to use the test results formatively because they need more detailed data on the student performance. With 15 minutes per sub-area, the tests have only limited precision. Teachers’ unions have reservations against the tests. Students receive only oral feedback and a standardised text from teachers about their test results. Although the tests are challenging for every student (as they are adaptive according to students’ answers), students generally find them fair. Parents also receive a summary of the test but can have difficulty in understanding what the results mean and therefore find it difficult to interpret them.

3.2. Linear digital tests

Linear digital tests, provided both by the Ministry and commercial providers, assess knowledge and skills in a specific subject area, using the same test items for all students. These tests provide more detailed data on students’ knowledge and skills than the national adaptive tests. However, they take more time as they require more test items.

At national level, digital linear tests are used at school-leaving examinations that allow limited access to help. Tests are online and browser based and consist only of closed questions and can therefore be graded automatically without the need for an examiner.

Figure 7 shows an example of a traditional commercially developed digital linear test in mathematics. It has a similar interface as national adaptive tests, albeit more colourful, and works with the same type of test items. This system takes an 8th grade student up to 4-5 lessons of 45 minutes to complete.
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Figure 8 shows an example of how a linear test presents results. They indicate the number of correct answers; colour-coded percentages and arrows indicate any increases or decreases compared to the previous year.

How can such data be used formatively?
First, when a linear test system is used over a period of time, the data and colour-codes can be used to indicate progress towards the common objectives of the national curriculum in a specific subject. Moreover, the test results can help to understand why a student struggles with a particular concept (e.g. *the concepts of equations and probability in mathematics*). The detailed overview, as shown in figure 9, reveals with which concepts in previous learning units the student still struggles (e.g. *how to add, subtract and multiply basic fractions*). In such a case the student could be advised to revise an earlier learning unit (e.g. *fractions*).

![Student progression in Common Objectives](image)

**Figure 9**: Example of display of results of digital Maths test from a commercial provider

### 3.3. Individual digital student plans

‘Embracing change is not immediate; we have to work together with teachers to help them to familiarise themselves with tools such as student plans.’

**Helder Pais, study visit participant, Portugal**

Student plans are another formative digital tool in use in Danish schools. Every student is required to have an individual digital plan which includes the results of tests in selected subjects and sets out a course of action based on them. At grade
8 and 9, they include an assessment of the student’s readiness to move to the next school level. Student plans – available online to parents – should be used at least once a year for all students up to 9th grade.

The student plan has several purposes: to provide feedback to students and parents and as a pedagogical tool for teachers. The sector, however, requests changes to the concept of student plans. In many cases students, parents and teachers do not perceive student plans as a relevant tool. In practice, ongoing assessments often happens with other tools than the student plans. Student plans have been criticised as being too rigid, as they are auto-generated. In the light of the above, the Ministry raised the question whether student plans perhaps tried to serve too many purposes at once. Other related questions currently under discussion are:

- Are student plans outdated, and should be replaced by continuous feedback? If so, how could the Ministry support such continuous feedback?

- If the decision was not to continue the student plans, how to secure feedback to students and parents and provide relevant digital tools to teachers?

- Finally, how can the Ministry balance the empowerment provided with such tools against the risk of teachers feeling controlled?

In January 2019, a political decision was taken to form an advisory board to revise the student plan. The group was tasked to produce recommendations by spring 2020 after which a political decision on the student plan was to be taken.

Despite the concerns over student plans, the visit to the Buddinge School revealed an inspiring example of how a student plan can be put into practice using Solo Taxonomy (see section 5).
3.4. General considerations

As seen above, various digital tools and tests that foster DFA practices are already available to Danish schools. The Ministry provides both national adaptive and linear digital tests, as well as student plans, and several commercial providers also offer digital tests.

What is essential to run digital tests is, of course, a digital infrastructure providing access to digital devices and a stable, fast and reliable internet connection. Study visit participants were impressed by the fact that such provision is no longer an issue in Denmark, unlike in most other European countries. Denmark is therefore advanced in many ways as regards the exploitation of digital tools for formative assessment and can therefore serve as an inspiration to other countries.

The Danish Ministry of Children and Education shared the challenges ahead openly. In particular, schools have different views on the student plans and as a result they are under review. More generally, although schools already have a range of DFA tests and tools, there is room for improvement. One challenge is the need to clearly communicate the purpose of different tests not only to teachers and schools, but also to students and parents. Another is to make it easy for teachers, schools and municipalities to use the tests effectively and to combine the results of different sources in a formative way: the results of both digital adaptive and linear tests could be translated more clearly into concrete next steps for teaching and learning. Although digital linear and adaptive tests serve different purposes, they can be combined meaningfully (see also information box). In principle, the same data can be used by the Ministry, municipalities, schools and teachers – provided it is aggregated at the right level of detail for each stakeholder.

<table>
<thead>
<tr>
<th></th>
<th>Adaptive tests</th>
<th>Linear tests</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test items</strong></td>
<td>Student replies to a random selection of questions</td>
<td>Student replies to all questions</td>
</tr>
<tr>
<td><strong>Time required</strong></td>
<td>Less time required</td>
<td>More time consuming</td>
</tr>
<tr>
<td><strong>Data required</strong></td>
<td>Place students on a proficiency scale, less detail</td>
<td>Overview of students’ knowledge of specific subject areas</td>
</tr>
</tbody>
</table>

*Table 2: Comparison of adaptive and linear digital tests*
Further technical developments are likely to enable more advanced DFA practices. For instance, national digital tests currently work only with closed questions. Developments in the field of artificial intelligence might well make the use of open-ended questions possible, as well as the assessment of specific subject areas that cannot be assessed with the current tests (*e.g.* mathematical thinking). Such future developments however also highlight the need to discuss new questions arising around trust and safety issues, interpretation and usability of data, exchange of data about learning and ownership of data, as well as ethical issues. In the next section, a pilot in the municipality of Gladsaxe exemplifies this need.

The next sections put a spotlight on how crucial the municipality and school level is, in particular in Denmark, for a successful implementation of DFA practices. Study visit participants visited the Municipality of Gladsaxe and their school Buddinge, which provided inspiring examples of advanced DFA practices. The visit only amplified how much the success of DFA practices also depends on the capacity of each municipality, school and individual teacher to translate the data from different tests and tools into concrete teaching and learning activities that serve their students’ needs. The municipality needs to provide necessary resources such as digital infrastructure and training. School management need to provide a vision and school culture on assessment. Finally, teachers need to engage students in a new way of learning that puts students more in the driving seat of their own learning.
4. The DFA strategy of the municipality of Gladsaxe

‘It was good to see how a municipal government had approached change management in a systematic way - aligning methods, infrastructure, technology, school management and teachers with continuing professional development to deliver change with a purpose and goals.’

* Aivar Hiio, study visit participant, Estonia

The municipality of Gladsaxe, close to Copenhagen, is responsible for ten public schools and almost 7000 students. The creation of a 21st century learning environment is a key strategic goal for the schools in the municipality; table 3 summarises the municipality’s six priority development areas. The municipality is exploring how data can be used to support decision making and is identifying opportunities and barriers for better use of existing data to promote data-based learning to, for example, strengthen guidance and feedback given by teachers to students.

<table>
<thead>
<tr>
<th>Priority area</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.</strong> The use of data and formative evaluation</td>
<td>• To allow for more insights and actions by teachers and students</td>
</tr>
</tbody>
</table>
| **2.** Student voice and student choice | • Teachers listening to student needs  
• Students as co-developers participating in school development |
### Priority area Description

3. **Less teacher instruction**
   - Teachers as facilitator of more student collaboration, communication and engagement with learning

4. **Teaching methods**
   - Open-ended questions, problem solving, project-based learning, learning design processes, creativity

5. **Technology in the classroom**
   - Learning why, which, when and how to use digital tools and other technologies when learning. Understanding what it means and takes to participate in a digital society

6. **An active learning environment**
   - Where children can be physically active

### Table 3: The priority areas of the municipality of Gladsaxe

The municipality of Gladsaxe presented several initiatives to support schools in assessing students’ progress designed to support school management, teachers’ decision-making and to create conditions for a better dialogue between the different actors. Table 4 provides examples of such initiatives.

<table>
<thead>
<tr>
<th>Initiatives</th>
<th>Goal/ description</th>
</tr>
</thead>
</table>
| 1. Creating dashboards | • To follow progress by tracking the development of individual students and groups of students over time  
  • The dashboards include:  
    › Survey data (for example about the well-being and/or motivation of the students)  
    › School absences  
    › Test scores (mathematics tests, reading tests)  
    › Grades |
| 2. Ensuring the combined use of multiple data sources and types of data (both quantitative and qualitative data) | • to achieve a comprehensive and in-depth knowledge about students’ learning and progress |
Table 4: DFA initiatives of the municipality of Gladsaxe

<table>
<thead>
<tr>
<th>Initiatives</th>
<th>Goal/ description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Supporting the use of data in combination with close knowledge about students</td>
<td>• especially teachers’ knowledge</td>
</tr>
<tr>
<td>4. Supporting different stakeholders in interpreting and using data</td>
<td></td>
</tr>
</tbody>
</table>

A GLADSAXE MUNICIPALITY PILOT: DATA-SUPPORTED EARLY DETECTION OF CHILDREN AT RISK

The municipality of Gladsaxe had considered running an experiment to help identify children at risk of becoming vulnerable. The goal was to offer early intervention to support those children still at a very young age as well their families. Research offers evidence of risk indicators, e.g. divorce and the child not attending recommended doctor appointments.

By cross-referencing existing data on children and their parents from different sources, the municipality aimed to detect children at risk before they actually showed symptoms of neglect, abuse or a lack of well-being. Families whose child might be at risk of becoming vulnerable would be contacted by the social welfare services and offered different kinds of help. A successful intervention could minimize or even eradicate the possibility that the child would later become vulnerable. Social workers were involved in the analysis of the data and the results of this analysis were shared internally. It was planned to hire additional staff to ensure that the interventions were compliant with GDPR requirements.

At the time of the visit, the experiment was on hold due to some concerns related to data privacy and ethical issues. This example sparked a lively discussion among study visit participants on what kind of use of data is possible and whether all possible uses of data are desirable.
‘The presentation made by the Gladsaxe City Council representative on their pilot was really thought provoking. We should be cautious with the use of big data, especially in a social context. The purpose of using data from different databases is to make predictions about a persons’ future behaviour, and to provide positive interventions based on this prediction. Such approaches have great potential – provided that we clearly define our goals, the nature of such interventions, and what use of data we find acceptable as a society or not.’

Aivar Hiio, study visit participant, Estonia
Buddinge School is one of ten public schools in Gladsaxe catering for 750 students from different backgrounds aged 6 to 16. The school's focus is on student learning, teaching students how to learn and supporting them to become content producers. DFA practices are used as educational tools. In particular, the school uses a digital portal and a digital formative approach based on the SOLO taxonomy. For several years, teachers, students and parents have been able to access all lessons, including a description of the specific lesson goals on the school's digital platform. More recently, the school started using the SOLO Taxonomy approach on the same portal.
5.1. The school portal

Buddinge School developed their own school portal (Skole Portal) with EasyIQ, a provider they chose themselves (schools are free to choose their provider). Teachers use the portal to create their lessons, with 18000 items in the database (see figure 11). For each lesson they fill in an index card with the title, purpose of the lesson, classes involved and start and end dates. Teachers, students and parents can see the lessons. Teachers can also copy lessons from their colleagues, based on the motto: “if it is good enough for your class you can share it with others.”

For each lesson, teachers choose learning goals following the national curriculum via a professional tool only available to teachers (see figure 12) enabling them to describe their aims as free text. They can also select goals for their lesson from a list of 300 items, including responsibility, collaboration skills, fantasy, self-control, empathy, etc. (see figure 13).
5.2. DFA based on the SOLO Saxonomy

Buddinge school provided the visitors with an example of how to use the student plans formatively that Danish schools are required to use. The school decided to base their formative assessment approach on the SOLO Taxonomy (structure of observed learning outcomes) as put forward by Pam Hook, without any involvement or direct contact with Pam Hook herself.
As described on Hook’s website, the taxonomy makes a distinction between declarative and functional learning knowledge. The assumption is that students first need to have some declarative knowledge about a topic (e.g. knowing something about surfing) before they can acquire the functional knowledge (e.g. surfing) (see figure 14). With the help of the SOLO taxonomy, students learn to monitor their own progress in a learning task and to make more smart decisions on their next steps. SOLO teaches students that learning outcomes are the result of effort and the use of effective strategies rather than luck or fixed abilities.

Students self-assess learning outcomes for different tasks. The SOLO taxonomy is structured around three main questions: What am I learning? How is it going? What do I do next? The taxonomy structures and organises stages of understanding at three levels, surface, deep and conceptual. At first students pick up only one or few aspects of the task (uni-structural), then several aspects that are unrelated (multi-structural), then learn how to integrate them in a whole (relational), and finally learn to generalise that whole to as yet untaught applications (extended abstract). The overview (see figure 15) lists typical verbs at each level (e.g. remembering, reflecting, planning, prioritising). When teachers talk with their students about this approach, they use these verbs. That way, the language can help teachers and students with their learning and can also be directly linked to curriculum goals.

Figure 15: Levels of Solo Taxonomy (Pam Hook)
Learning goals are shared with students at the beginning of the learning unit. One example of a concrete learning goal is ‘I am learning to analyse the development of the characters of the novel’ (see figure 16).

Students also enter their own learning intentions in the online platform. At the end of the unit, both student and teacher assess the students’ learning (see figure 17). During lessons, students can also use hand signs to provide quick feedback on where they are at with their learning (see figure 18).
5.3. Reflections on the school visit

‘I really liked to see that the students of the class in the school we visited mostly liked the online tools that they used. It was normal for them to do their school tasks and homework on the computer and most of them also liked to do it that way.’

Michael Jeitziner, study visit participant, Switzerland

The formative assessment approach based on the SOLO Taxonomy helps students to develop a better understanding of topics and to learn how to learn and think—something that cannot be measured in national tests, according to one school teacher. Students generally find it very motivating to take responsibility for their own learning, she added. However, implementing teaching and learning based on the SOLO Taxonomy is a comprehensive approach that needs time, training and the support of actors at different levels. The Ministry requires and supports the development of individual digital student plans, and the municipality of Gladsaxe provides resources and strong support. One important enabler is the fact that the school was able to collaborate with the platform provider directly to discuss expectations on what the platform needs to be able to do. At first there was strong opposition from teachers in the municipality to this new approach and this indicates how important it is to get teachers, students and parents on board. There needs to be a clear message and rationale as to why such a new approach to learning and assessment is beneficial.

Reflecting on the school’s approach, study visit participants raised a number of questions:

• What other taxonomies than SOLO are there? Should all schools use the same? Who should decide what taxonomy to use?

• Why has the improved way of learning for students not yet been reflected in better results in national tests? Is it because change requires more
time, or is it because the national tests do not measure the new skills that students acquire (e.g. collaboration)? Often, there is a certain discrepancy between what is required in the curriculum and what is actually tested.

- How to organise data collection for formative purposes in a way that respects data privacy and ethical obligations? In some countries, data can only be collected for very specific purposes.

- How to bring parents on board? Parents for example in Belgium often demand to know what kind of digital platforms are used in school and who third-party providers are.
6. Conclusions and recommendations

“The key to me is the story underlying the data.”

*John Hattie⁴, University of Melbourne, 2013*

During the study visit Danish stakeholders openly shared the challenges they face with participants, and this enabled a meaningful exchange on current opportunities and challenges related to implementing DFA practices. The school visit, insights provided by the Ministry of Children and Education and discussions among study visit participants not only led to a wealth of conclusions but also raised new questions and considerations.

With 10 years of experience with national digital tests, a variety of digital tests and tools available to schools, and a stable digital infrastructure in place, Denmark is already quite advanced as regards the exploitation of digital tools for formative assessment and can therefore serve as an inspiration to other countries.

However, the discussion also revealed remaining challenges and open questions, for instance: How to combine different digital formative tools and their results to effectively inform next steps of teaching and learning? How to clearly outline the rationale of each tool to different stakeholders? How to enable an advanced use of DFA practices, while safe-guarding data privacy and taking into account any ethical considerations that may arise? And finally, how to assess also new skills fostered by DFA practices such as self-reflection and collaboration?

Countries have different visions of assessment and education systems are organized quite differently across Europe. Nonetheless, there are a number of considerations that are useful to take into account for policy makers aiming to integrate DFA practices in their national or regional school curricula. Below, eight

⁴ [https://visible-learning.org/2013/01/john-hattie-visible-learning-interview/](https://visible-learning.org/2013/01/john-hattie-visible-learning-interview/)
such considerations are listed, on the basis of what has been learned from this study visit:

**Define a common understanding and vision, and provide a clear rationale to stakeholders**

1. **Establish a common understanding and vision of what defines DFA practices**, and how they relate to and can be combined with summative assessments to support learning. While DFA practices can be quite diverse, their common goal is to understand the learning needs of every student in order to help them take more control of their learning. One prerequisite is that the general vision of education and beliefs about teaching and learning are consistent with this goal.

2. **Communicate the rationale for using specific digital tests and tools clearly to stakeholders.** In Denmark a variety of digital tests and tools is available. Although a great asset, this increases the need to explain their specific purposes and how they relate to each other to different audiences, including students and parents. For instance, national adaptive tests can place students on a proficiency scale, while digital linear tests provide information on students’ knowledge of specific subject areas. One lesson learnt from experiences with Denmark’s student plans is that if a digital tool is to serve multiple purposes (e.g. student feedback, feedback to parents, pedagogical tool for teachers), there needs to be careful consideration as to what extent these different purposes are compatible with each other.

**Collect data to inform DFA practices and foster capacity building and collaboration**

3. **Collect or enable the collection of data that is relevant, available in adequate quantity and properly interpreted** so it can effectively be used in planning next steps in teaching and learning. Data can, in principle, inform decisions taken at different levels, by teachers, school managements, municipalities, regional governments, national ministries, as well as students themselves and their parents. To that end, training needs to take place. For instance, for municipal staff, this means to learn how to understand, interpret
and make decisions based on evaluation and assessment data collected from schools (OECD, 2016).

4. **Establish and promote trustful and equal cooperation between the ministry, regional governments, municipalities, schools and companies** that provide digital tools and tests. The close cooperation between Buddinge school in Denmark and the developer of the digital platform the school used, including exchanges on respective expectations regarding the platform, was a key enabling factor in its successful use.

**Provide schools with adequate infrastructure and necessary support**

5. **Provide or support the provision of adequate school infrastructure (devices, high bandwidth) and technical support.** For many DFA practices, a 1:1 student-device ratio is ideally required. Some practices such as the use of the personalised learning platform in Buddinge school also require home access to a device and internet.

6. **Provide schools with support to integrate DFA practices that are compatible with their own vision and culture.** The school level is crucial for a successful implementation of DFA practices. While schools need a certain degree of flexibility to change practices, this flexibility is more important for the successful implementation of DFA practices, because their goal ultimately is to strengthen relationships between teachers and students.

**Invest in relevant expertise and future research**

7. **Invest in staff or collaborations with stakeholders with relevant expertise.** For instance, specific expertise is required to design a valid, reliable digital tool that tests reliably what it is supposed to test. Specific technical knowledge is required at different levels to ensure inter-operability between different digital assessment tools. Furthermore, questions around trust and safety issues, interpretation and usability of data, exchange of data about learning and ownership of data, as well as ethical issues need to be addressed at different levels. This is all the more pertinent as new technical
developments emerge that enable interesting possibilities to exploit data. Discussion of these questions is essential as well as training opportunities that can translate into effective strategies to, for example, continue to safeguard student data privacy.

8. **Invest in research to further refine the potential impact of DFA practices.**

Research has already confirmed the potentially powerful impact of DFA practices on student learning. However, there are still many unanswered questions to be addressed by future research: Which DFA practices are particularly impactful, in classroom as well as remote learning settings? How to combine formative and summative assessments effectively? How to design DFA practices in a way that really empowers students? Empowering students is often put forward as one principal goal of introducing DFA practices. Therefore, particular focus could be put on providing new evidence on how to design DFA practices that effectively empower students in their own learning. No systematic overview is available yet on schools’ current DFA practices across Europe. Research projects like the Assess@ Learning project aim to contribute to this growing body of evidence.


ANNEX I:  
DFA examples using apps and software

DENMARK: EYEJUSTREAD – AN APPLICATION TO SUPPORT BETTER READING

During the study visit, Simon Egenfeldt-Nielsen and Janus Askø Madsen, CEOs of EyeJustRead presented their application, EyeJustRead, an example of technology providing more timely and precise feedback than humans. The application is based on eye tracking to support reading in primary school. In 2016, EyeJustRead started with a grant from the Danish Ministry of Children and Education and it was launched in 2017. 30 Danish schools are already using the application.

With a library of more than 150 books, EyeJustRead can help students with reading difficulties to read. Teachers and experts use the library to organise reading sessions with students. After each session the reader’s eye movements and voice data can be reviewed and analysed. The analysis helps teachers find, for instance, patterns of similar mistakes. The data itself do not prescribe the intervention but informs the planning of possible strategies.
IRELAND: ‘PHYZ’– IRELAND’S FIRST FORMATIVE EDUCATION APP

Study visit participant Tony Weir of the Department of Education and Skills, Ireland, described ‘Phyz’, an app developed for formative assessment, first released in 2018. It is free for students but with a cost per student to host the app on the server. The idea behind it is that using it will encourage young people to engage in and keep to regular physical activity. The app was developed to support learning as part of the non-examination syllabus for the senior cycle (age 16-18) Physical Education. The formative elements enable teachers to provide feedback to students: students can show evidence of their physical activities (e.g. walks) on which teachers can provide feedback. The app was tested in a pilot with six physical education teachers organised by the University of Limerick together with the National Council of Curriculum and Assessment. Early results of the pilot show that students found the app motivating.
ANNEX II:
Assessment practices in countries represented by study visit participants

This country information has been provided by study visit participants during the visit.

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>OVERVIEW</th>
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<tbody>
<tr>
<td>Belgium</td>
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<tr>
<td>Flanders</td>
<td>• There is a new government in Flanders. The Ministry provides support and advice, as schools have considerable autonomy.</td>
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<td></td>
<td>• GO! Is currently constructing IXZO!, a platform based on AI, in cooperation with Century (see also this video).</td>
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<tr>
<td>Belgium</td>
<td>In the frame of compulsory education:</td>
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<tr>
<td>Wallonia</td>
<td>• The Ministry issues recommendations to guide schools in the choice of their educational digital tools, for example data protection recommendations.</td>
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<td></td>
<td>• Schools are free to choose the digital tools they want to use. Since September 2020, the Ministry is offering the use of its own e-learning platform. Its use is optional.</td>
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<tr>
<td></td>
<td>• These platforms are mainly used to give lessons, and if exams are carried out, these are formative and not summative.</td>
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<tr>
<td></td>
<td>• There are general summative examinations (non-digital).</td>
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<tr>
<td>Croatia</td>
<td>• There has been a national test occasionally and every year a state matura.</td>
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<tr>
<td></td>
<td>• The curriculum reform is in full roll-out, with two components that focus on assessment:</td>
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<tr>
<td></td>
<td>› Teachers are trained continuously on how to carry out formative assessments (Assessment as learning and for learning)</td>
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<tr>
<td></td>
<td>› A framework and guidelines for assessment as learning, for learning and of learning were published</td>
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41
<table>
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<tr>
<th>Country</th>
<th>Overview</th>
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</table>
| Greece | • Although the importance of formative assessment in the Greek educational system is foreseen by related legislation (e.g. **PD 8/199**), there are gaps in the regulatory framework and a lack of centrally described methods and tools.  
• Teachers use various forms of assessment during the school year, as they see fit, in order to assess the needs of their students and/or take the results into account for the students’ evaluation.  
• In secondary education, there is a compulsory summative assessment at the end of the school year, that counts towards the final student grade. This assessment is currently the responsibility of the school, although the Ministry of Education has announced plans to partially centralize it through a common national digital database of assessment items.  
• Students are assessed on the basis of their performance during two quarters. At the end of each quarter, guardians/parents are informed and receive the student’s individual progress fact sheet.  
• CTI “Diophantus” (**MoE’s institute**) administers centrally the databases of school, teachers and student data (**including grades**).  
• The selection of students for higher education, is based mainly on a centrally planned and administered national examination (**taking place in 12th grade**).  
• Digital tests are used for the national certification of teachers’ competences for the use of technology in their pedagogical practice (**“B-level” certification**) and, since the school year 2018-19, for the national certification of students’ digital competences. These are individual/differentiated e-tests, randomly generated from a large pool of items, parameterized (**i.e. duration, difficulty level, curriculum**), and securely distributed/collection to/from the national testing centers (**university & school IT labs**). |
| Estonia | • There are centrally provided diagnostic tests, which only the authorized teachers are allowed to access.  
• Most schools have e-school solutions, as school owners made it mandatory for schools to use the systems.  
• The different platform providers are in competition. The HITSA agency started to work on a co-creation program that links companies with individual schools and provides information on what schools need. |
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<th>COUNTRY</th>
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| Ireland | • The performance of individual cohorts of students in high-stakes state examinations informs school management as to the performance of their own school.  
  • Future final examinations will include two new areas:  
    › In computer science online testing in coding  
    › First high-stakes examination in physical education (*including videos, online portfolios*)  
  • The app ‘Phyz’ for formative education in physical activities has been developed and piloted (*for more information see Annex I*). |
| Italy   | • As of 2020, students will have to take a standardised test before their final school leaving exams. So nowadays, the grades involved are 2,5,8,10 and 13.  
  • In 2018, over 90% of 10th grade students participated to the test.  
  • There are some reservations against standardised tests for all schools, as for instance parents are afraid of their children being ‘classified’ |
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<tr>
<th>COUNTRY</th>
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| Malta   | • There is no national DFA policy. Currently, there are no plans to introduce a digital assessment policy. All national tests (*called ‘benchmarking tests’*) are not digital.  
• Digital tools are voluntarily used by teachers both during the teaching process and for assessment purposes. However, these are not used in national assessment tests.  
• Experience from the previous secondary school educational system showed that a one-size system does not fit all - hence the change to a framework called myJourney. Via this revamped educational system, secondary-school students will have compulsory lessons in key competences, including the option for functional subjects, as well as the opportunity of selecting other academic, vocational and/or applied subjects.  
• The framework is based on learning outcomes (*mostly grounded on the Bloom's taxonomy*) which leads the students to a Secondary Education Certificate (SEC) or Secondary Education Applied Certificate (SEAC). The aim of the My Journey educational system is to provide a more relevant schooling experience to students and thus mitigating the problem of early school leavers.  
• In secondary education, formative assessment does not only serve as a diagnostic tool, but the students’ achievement from these assessments is integrated with the summative assessment. Hence, the overall grade at the end of the school year does not present the students’ performance at a snapshot in time but a holistic overview of the students’ performance during the entire school year. |
| Netherlands | • A compulsory primary school leaving attainment test is organised.  
• There are issues with comparing results of digital tests provided by different suppliers.  
• Using digital tools for formative assessment raises questions: Who owns the data, how to use it, are unique log-ins required? |
<table>
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<tr>
<th>COUNTRY</th>
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<tbody>
<tr>
<td>Poland</td>
<td>• General law regulation on assessment is provided at the national level.</td>
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<td></td>
<td>• National test is mandatory after primary school.</td>
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<td></td>
<td>• Anonymous and aggregated data is collected at central level to support education policy.</td>
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<td></td>
<td>• All the external tests are customized to the types of students’ special needs.</td>
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<tr>
<td></td>
<td>• Individual data on assessment is visible at the school level (<em>students, teachers, headmaster of the school</em>).</td>
</tr>
<tr>
<td></td>
<td>• Ensuring data privacy is important.</td>
</tr>
<tr>
<td>Portugal</td>
<td>• National tests are mandatory.</td>
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<tr>
<td></td>
<td>• The Maia Project is a research project at national level aiming to improve the assessment of students’ learning in the classroom to help them to better succeed:</td>
</tr>
<tr>
<td></td>
<td>‣ The target group is mainstream education courses and vocational courses from primary to upper secondary education.</td>
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<tr>
<td></td>
<td>‣ It involves classroom assessment workshops where students have the opportunity to experiment with several formative assessment tools and techniques. Representatives of the teacher training centres at school level build teacher capacity so that each teacher can directly apply these tools and techniques with their own students.</td>
</tr>
<tr>
<td></td>
<td>‣ A core team consisting of delegates from the DGE/Ministry of Education, a higher education institution and school clusters/schools across mainland Portugal monitor this project.</td>
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<td></td>
<td>‣ On the basis of this project, a scaled-up intervention is planned.</td>
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<td></td>
<td>‣ There is high interest from schools to participate.</td>
</tr>
<tr>
<td>Switzerland</td>
<td>• Some testing takes place at canton level, no big tradition to compare test results between cantons.</td>
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<tr>
<td></td>
<td>• A national <a href="#">testing</a> of some common strategy goals of the cantons exists.</td>
</tr>
<tr>
<td></td>
<td>• <a href="#">Lernlupe</a> is an online platform and a possibly interesting example of a DFA practice in the canton of St. Gallen.</td>
</tr>
</tbody>
</table>
Spain

- In the national curriculum, assessment has been developed taking into account not only assessment criteria, but also learning standards which make it easier to focus on the formative, continuous character of the assessment of students in secondary education.

- ICT must be tackled in all subjects which is why the Ministry finds it important for teachers to not only include ICT in their daily educational practice but also in the evaluation of student outcomes.

- Both digital and ‘learning to learn’ competences are core and compulsory.

- There is no official definition of DFA in Spain, but, in the 2018 National Law of the Educational System (LOMCE) the following issues are related to assessment and ICT for compulsory secondary education:

  - “The assessment of the learning process of the students in Compulsory Secondary Education will be continuous, formative and integrating.”

  - “Both the Educational Administrations and school leaders will promote the use of ICT in the classroom as an appropriate and valuable didactic means to carry out teaching and learning tasks.

  - “ICT, entrepreneurship and civic and constitutional education will be developed in all subjects”.

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## ANNEX III:
### List of study visit participants

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>FIRST NAME</th>
<th>LAST NAME</th>
<th>ORGANISATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>BELGIUM (FR)</td>
<td>Adrien</td>
<td>Pelzer</td>
<td>Ministère de la Fédération Wallonie - Bruxelles</td>
</tr>
<tr>
<td>BELGIUM (NL)</td>
<td>Philip</td>
<td>Lambrechts</td>
<td>GO!</td>
</tr>
<tr>
<td>BELGIUM</td>
<td>Anja</td>
<td>Balanskat</td>
<td>European Schoolnet</td>
</tr>
<tr>
<td>BELGIUM</td>
<td>Katja</td>
<td>Engelhardt</td>
<td>European Schoolnet</td>
</tr>
<tr>
<td>BELGIUM</td>
<td>Patricia</td>
<td>Wastiau</td>
<td>European Schoolnet</td>
</tr>
<tr>
<td>CROATIA</td>
<td>Lidija</td>
<td>Kralj</td>
<td>Directorate for Support and Improvement of Education System</td>
</tr>
<tr>
<td>FRANCE</td>
<td>Janet</td>
<td>Looney</td>
<td>European Institute of Education and Social Policy</td>
</tr>
<tr>
<td>GREECE</td>
<td>Nena</td>
<td>Karagianni</td>
<td>Computer Technology Institute and Press “Diophantus” (CTI)</td>
</tr>
<tr>
<td>ESTONIA</td>
<td>Aivar</td>
<td>Hiio</td>
<td>HITSA</td>
</tr>
<tr>
<td>IRELAND</td>
<td>Tony</td>
<td>Weir</td>
<td>Department of Education and Skills</td>
</tr>
<tr>
<td>ITALY</td>
<td>Alessandro</td>
<td>Ferrini</td>
<td>INDIRE</td>
</tr>
<tr>
<td>ITALY</td>
<td>Maria</td>
<td>Guida</td>
<td>INDIRE</td>
</tr>
<tr>
<td>MALTA</td>
<td>Josmar</td>
<td>Borg</td>
<td>Ministry for Education &amp; Employment (MEDE)</td>
</tr>
<tr>
<td>NETHERLANDS</td>
<td>Eric</td>
<td>Welp</td>
<td>Kennisnet</td>
</tr>
<tr>
<td>NORWAY</td>
<td>Morten</td>
<td>Soby</td>
<td>Norwegian Directorate for Education and Training</td>
</tr>
<tr>
<td>COUNTRY</td>
<td>FIRST NAME</td>
<td>LAST NAME</td>
<td>ORGANISATION</td>
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<td>------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>POLAND</td>
<td>Anna</td>
<td>Chrościcka</td>
<td>Innovation and Technology unit Ministry of National Education</td>
</tr>
<tr>
<td>PORTUGAL</td>
<td>Helder</td>
<td>Pais</td>
<td>Ministry of Education</td>
</tr>
<tr>
<td>SPAIN</td>
<td>Mirian Olga</td>
<td>Cecilia Martinez</td>
<td>Ministry of Education, INTEF</td>
</tr>
<tr>
<td>SWITZERLAND</td>
<td>Michael</td>
<td>Jeitziner</td>
<td>educa.ch</td>
</tr>
<tr>
<td>SWITZERLAND</td>
<td>Nicolas</td>
<td>Martignoni</td>
<td>Teacher, ICT advisor for the Directorate of Education, Culture and Sport of the City of Freiburg</td>
</tr>
</tbody>
</table>
ANNEX IV:
Study visit programme

26 NOVEMBER 2019
Arrival in Copenhagen and working dinner

27 NOVEMBER 2019

9:30 - 11:30 Buddinge Skole, Søborg
› Presentation of tool developed by EasyIQ for digital formative assessment (based on SOLO Taxonomy)
› Observation of 7th grade pupils working with the tool
› Discussion with teacher and pedagogical consultant from the municipality

Meeting at the Ministry of Education and Children
Exchanges of views about the school visit and Lunch

13:30 - 14:00 Digital formative assessment in Denmark from the Ministry’s viewpoint
Trine Elmelund Christensen, Head of Office, Ministry of Children and Education
Rasmus Ulsøe Kær, Specialist Consultant, National Agency for Education and Quality

14:00 - 14:45 Digital formative assessment in Denmark from a researcher’s viewpoint. How far are we in Denmark?
Jens Jørgen Hansen, Associate Professor, University of southern Denmark - Design department

14:45 - 15:15 Questions/discussion

15:30 - 16:00 Digitization of summative tests in Denmark - Q & A
Kristian Johnsen, National Agency for It and Learning

16:00 - 16:30 Assess@Learning – about the project - EUN/international focus on digital formative assessment
Anja Balanskat, European Schoolnet
## 28 NOVEMBER 2019

**Meeting at the Ministry of Children and Education**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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| 9:15 - 10:00 | Pros and cons of mandatory national tests (digital and adaptive) used for formative assessment  
*Thorkild Svendsen, Chief Consultant, National Agency for It and Learning* |
| 10:00 - 11:00 | Exchange on study visit: Lessons learned – and insights from participating countries |
| 11:15 - 11:45 | Recap and discussion about possible future collaboration |
| 11:45 - 12:00 | Debriefing and evaluation |
|            | Light lunch and departure                         |

**16:30 - 17:15**  
EyeJustRead - An application based on eyetracking that supports better reading in primary and lower secondary school  
*Simon Egenfeldt-Nielsen and Janus Askø Madsen, CEOs EyeJustRead*

**17:15 - 18:00**  
Day 1 study visit debriefing

**19:30**  
Working Dinner
Strategies to include digital formative assessment in the Danish school system

European Schoolnet’s 2019 Study Visit

www.europeanschoolnet.org