

Main findings

The *ARK&APP* project studies how educational resources¹ are chosen and used in four school subjects (English, Mathematics, Natural Science, and Social studies), at three levels in primary and secondary education in Norway.

The *ARK&APP*-project contributes new research into how paper-based and digital educational resources are selected and used in Norwegian schools. Our analysis present the various functions educational resources can serve within different ways of organizing teaching.

The changing form and function of educational resources in Norwegian classrooms become most visible when students work with multiple sources and representations. Across subjects, but most notably in Natural Science and Social Studies, the *ARK&APP* project describes how students are often asked to explore various sources, and to synthesize information, while in the learning processes. Students commonly express enthusiasm when engaged in activities of this sort. Working with multiple sources is cognitively and socially demanding as pupils and teachers must make use of strategies in order to delve deeply into a subject. This important finding has implications both for the role of the teacher in the classroom, and for our understanding of how teaching should progress over time.

When using multiple sources, teachers should exploit a repertoire of strategies in order to help student integrate various types of information; knowledge integration. In cases where students work with several different digital tools, teachers will have to spend a good chunk of their time on aiding technical difficulties. Furthermore, they will have to guide students in understanding how to solve the tasks using digital tools.

In the 12 case reports we study complete, but time-limited, teaching units and it is therefore impossible to address student progression over a longer period of time. However, we find strong indications that learning resources rarely have the same in-built learning progression that textbooks and textbook series offer. Where learning resources are widely used, teachers must know how to design longer teaching units both integrating and structuring learning resources so that students are appropriately challenged over time in their efforts to achieve a competence aim.

In this final report from the project we summarize findings with regards to how school owners, -leaders and teachers select educational resources and the function these resources serve in learning and teaching. The project works with five research questions. The first two (see below), examine how

¹ We use the term *educational resources* when referring to paper-based and digital resources used in teaching that were originally developed with the Norwegian curriculum in mind, typically a textbook. In order to describe resources originally produced for other purposes, but used in the classroom by teachers and students, we use the term *learning resources*. Examples are Wikipedia entries, magazines and TV shows.

educational resources are selected, as well as their significance for the way teachers interpret and operationalize the *Knowledge Promotion Reform* (LK06).

- ❖ *Which educational resources are chosen, and on what basis?*
- ❖ *How do educational resources help teachers' interpret and operationalize the curriculum?*

To answer research question 1 and 2 we analyze quantitative data from three surveys: The 2013 and 2014 versions of the annual *Questions for School-Norway*, aimed at school owners and school leaders, and a separate teacher survey. In this, teachers in four subjects answered questions about their use of educational resources when planning and teaching.

- ❖ Teachers are in charge of selecting the textbooks they use, a selection which is done in teams and on professional grounds.
- ❖ Primary school teachers generally select paper-based educational resources, but supplement with digital educational resources and other learning resources.

In order to understand the impact educational resources have on curricular interpretations, we examine how they influence teachers' perceptions of competence aims as they engage in lesson planning. Our findings largely separate into two categories: foundations for interpretation, and the function of educational resources:

- ❖ A majority of teachers believe teacher editions and textbooks are important when working with competence aims in lesson planning. Primary school teachers are more likely to find teacher editions important than their colleagues in upper secondary school.
- ❖ A majority of teachers agree or strongly agree that what they perceive as their prime educational resource covers all subject competence aims.
- ❖ When primary school teachers find certain competence aims are not covered well by a textbook, they make use of additional educational resources and other learning resources to compensate for the gap. In upper secondary school, a range of educational resources and other learning resources share status as prime resource in lesson planning.
- ❖ When teachers interpret the curriculum, textbooks – by virtue of their in-built didactics and progression plans – become more important than other learning resources. Furthermore, these additional learning resources seem to serve other functions than textbooks when it comes to teachers' operationalization of the curriculum.

When answering research questions 1 and 2, we use data collected from school owners, school leaders and teachers. Overall, the three groups of respondents answer quite consistently. However, it is from teachers, and from observing their classroom practice, we can truly seek to understand the function(s) of educational resources in teaching. Therefore, research questions 3, 4 and 5 are mainly concerned with instruction and student learning. To answer these questions we have conducted 12 case studies of complete teaching units, in four different subjects: English, Mathematics, Natural Science, and Social studies. In addition, we have designed and distributed a national questionnaire directed at teachers of these four subjects. In our analysis, we examine variation between subjects, and between three levels of primary- and secondary education.

Research question 3-5 (see below), shed light on how educational resources are used, their function, and how they foster motivation that may be turned into a learning outcome.

- ❖ *How are educational resources used during lessons?*
- ❖ *What role do educational resources play in student and teacher interactions?*
- ❖ *How do educational resources foster student motivation and learning?*

Our findings are structured in the following manner: First, we present an analysis of data from the teacher questionnaire, and then we summarize findings across all 12 case studies. In what follows directly below, we summarize questionnaire findings addressing how educational resources are used in teaching units.

- ❖ Results of the teacher survey indicate that teacher instruction accounts for nearly half of all lesson time.
 - Monological instruction, or instruction characterized by the teacher lecturing, seems to be particularly prominent in Natural Science and Social science.
- ❖ Results of the teacher survey indicate that in an average lesson in Norway, pupils are more likely to be working individually than in groups.
 - The difference in minutes spent on individual work and group work is particularly noticeable in Mathematics, where individual work seems to be the preferred approach.
- ❖ Results of the teacher survey indicate that the educational resource most frequently used in Norwegian lessons is the paper textbook.
 - Non-digital workbooks and notebooks are much more common among primary school pupils than pupils of upper secondary school.
- ❖ Results of the teacher survey show that digital educational resources and other teaching resources are more frequently used in upper secondary school than in primary school.
 - In primary school, 60 percent of teachers state that they primarily use paper-based educational resources in teaching. However, they make use of additional digital resources when they see fit.
- ❖ Results of the teacher survey indicate that in upper secondary school subjects vary in their preference for either paper-based or digital educational resources.
 - For Mathematics, paper-based educational resources are as common in upper secondary school as in the primary years.
 - For English and Social Science, less than 50 % of teachers report that they mainly use paper-based educational resources in teaching.
 - In upper secondary school, digital educational resources are frequently used in English, but seldom in Mathematics.

While the teacher survey, through self-reporting, provide information on the methods and educational resources teachers used in their latest lesson, our case studies address how educational resources are used, and how they foster motivation and learning. Across the four subjects, the case studies reveal certain common denominators:

- ❖ The synthesis report shows that in instruction, teachers make extensive use of self-produced educational resources, most prominently PowerPoint presentations.
 - The presentations, which are used to structure both content knowledge and tasks, become vital for imparting knowledge and organizing instructional progress.
 - Such presentations are particularly important at the start of a lesson, and their importance diminishes as teachers approach the end of a lesson.
- ❖ The synthesis report shows that teachers' monological instruction both supplements and gives important introductions to content knowledge and tasks.
 - For lower level pupils to succeed with individual- and group work, or learning sequences with increased access to, and use of, educational resources and other learning resources, preparatory monological instruction appears an absolute necessity.
- ❖ In most of our case studies teachers use their own worksheets to structure teaching, but occasionally these worksheets are also used to simplify content knowledge.
 - Because they contain both content knowledge and information on proceedings, self-produced worksheets help tie teachers' instruction to the other teaching methods used in a lesson.
- ❖ The synthesis report shows that in group work, but to a certain extent in individual work as well, pupils make use of multiple sources, often containing conflicting information.
 - Working with multiple sources is highly challenging for the pupils.
 - When working with multiple sources it is essential that students receive teacher guidance.
 - When multiple sources are combined with digital technologies, teachers must provide guidance on content knowledge, task genre, and on use of the digital tool(s).
- ❖ The synthesis report show that paper textbooks functions as important structuring elements in lessons, and that they often function as point of departure for learning activities.
 - In general, learning resources do not have any in-built learning-progression. When teachers use multiple learning resources they have to create progression as part of a larger unit.
 - When pupils work with learning resources, teachers will have to spend a great deal of time on guiding and supporting their pupils' work.
- ❖ The synthesis report shows that digital educational resources, such as games and simulations, create enthusiasm.
 - This enthusiasm will only lead to learning if the game invites students to explore subject-related concepts and terms.
 - Some of the strategies students develop based on game logic appear ineffective, as they do not result in learning.