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WRITING TO READ
WITH DIGITAL TOOLS

Abstract

The purpose of this research is to provide an understanding of strategies for learning to read through writing on computers. This strategy is a radical turn in literacy learning from the traditional 'Reading and Writing' to 'Writing to Read'. A comprehensive research project in Norway, Denmark, Finland and Estonia showed that children from the first to the fourth grade developed satisfactory skills in reading and writing through writing on computers. The research project described here is a case study of how teachers and student-teachers implement strategies of writing to read for children. The study shows different situations where pupils develop knowledge and skills for both reading and writing through writing on computers. The study also shows similarities to more traditional reading and writing strategies. The study uses a sociocultural framework to explain the process of developing knowledge with digital tools.

Keywords: teacher education, ICT and learning, Arne Trageton, writing to read, socio-cultural.

Introduction

Learning to write has traditionally been seen as a sequel where reading is the starting point (S.A.H. Lyster, 2011). This view on writing and reading has been contradicted by Arne Trageton (2003; 2010). A three-year research project in fourteen classes in Norway, Denmark, Finland and Estonia shows that children from the first to the fourth grade developed basic skills in reading and writing through writing on computers (A. Trageton, 2003; 2010). A. Trageton's pedagogy is similar to American 'Writing to Read project. According to Greta Hekneby (2011, p. 72), who refers to Carol Chomsky (1982), writing is initially easier than reading for children. The experience of North European 'Writing to Read' project, published by A. Trageton (2003), is the basis of this case study. The case study is organized as part of an academic specialization in Teacher Education at Nesna University

College. The study focuses on how teachers develop the strategy of 'Writing to Read' with digital tools. The children's knowledge building is central in the teachers' and student-teachers' description of the implementation of A. Trageton's 'Writing to Read' concept. The study uses a socio-cultural framework (Y. Engestrøm, 2001; L.S. Vygotsky, 1986; G. Wells, 1998) to explain the process of developing knowledge.

Learning to write and read

There seems to be an agreement that learning to read and write is a process of coding, decoding and understanding (G. Hekneby, 2011). Reading can be seen as a product of decoding and understanding (P. Gough and W. Tunmer, 1986). Early training in reading and writing in Norway has traditionally been related to methods where sounds, words, word pictures and phrases are emphasized (S. Lyster, 2011). According to G. Hekneby, pupils "learned to articulate the letter at the same time they viewed it" (2011, p. 81). This method favours the decoding process – not understanding – and is described as 'phonetic', or as a 'bottom-up' method (G. Hekneby, 2011, p. 84). A common characteristic of these theories is that reading is emphasized as the basis for writing (A. Trageton, 2010). Research suggests that phonological coding plays an important part in the early stages of development of reading and that such coding and decoding is constructed on different phonological sub-processes (A. Bradly and P. Bryant, 1985). The focus of such processes often resides on the meaning of the text and the understanding of the individual child (S. Lyster, 2011). Processes that give priority to understanding can be seen as 'bottom-down' methods or 'whole language' methods (G. Hekneby, 2011, p. 84). In schools in Norway, there is often a mixture of methods which favour both the coding/decoding and understanding processes (G. Hekneby, 2011, p. 84).

'Speech Based Reading' (LTG) – developed by Swedish pedagogue Ulrika Leimar, is one of the methods that have been popular in Norway for the last several decades (G. Imsen, 2005). This method prioritizes the pupil's understanding and the 'whole language' process and is similar to American method called the Language Experience Approach (LEA-method). The strategy of learning to read based on speech (LTG) is also associated with 'Text Creation' (S. Lyster, 2011). This method, however, does not involve digital tools. Text discussion prioritizes the student's understanding and capacity to make valid contributions (S. Lyster 2011; G. Hekneby, 2011). The pupils write down their own spoken words and practice alphabetisation and spelling. The link between speech and text is established through the understanding of the words (G. Imsen, 2005; S. Holm, 1989). Greta Hekneby (2011, p. 90) recommends the use of this approach as a possible valuable combination of the 'phonetic' and 'whole language' methods.

Arne Trageton's concept of 'Writing to Read' focuses on the development of reading through computer based writing processes. Trageton summarizes the experiences of North European research project in his book (A. Trageton, 2003) and manual (A. Trageton, 2010). The manual is meant for teachers, parents and others involved in the implementation of this strategy. The project "Computer Based Text Creation, grades 1-4" helped the first grade pupils write their way to letter recognition and most of them even began to read. In the second grade, the students produced their own reading books and newspapers and focused primarily on the continual development of their reading skills. In the third grade, handwriting was introduced. In the third and fourth grade, the writing process was linked to the creative writing through 'Process Oriented Writing (T. Løkensgard Hoel, 2000). In addition to teacher's guidance, 'Process Oriented Writing' builds on the close interaction between the pupils themselves (A. Trageton, 2010; T. Løkensgard Hoel, 2000). According to G. Hekneby, this "is a writing process where production develops in conjunction with different texts and individuals" (2011, p. 68). A. Trageton's concept of 'Writing to Read' in the first grade emphasizes eight stages, with a preparation stage and concluding stage. The stage of preparation emphasizes the interaction with parents. It also includes classroom methodology where students work in pairs with one computer. The keyboard is logically divided in two, and the computer has access to a printer. At the first stage, the pupils start with writing letter rows on the keyboard. Pupils are asked to recognize letters. The next stage is to write rows of letters that comprise the pupil's own name. The third stage is to create stories with rows of letters and words, often linked with drawings and pictures. The fourth stage emphasizes words which are linked to rows of letters in stories. The next stage is the production of dictionaries. This is followed by a stage where the focus is on spelling. The seventh stage gives priority to the development of sentences and spaces. The last stage focuses on stories. The end of this process involves the parents and preparing for the next year's more sophisticated text creation. According to G. Hekneby (2011), the first two years can be seen as 'the first education in writing and reading' and give priority to the learning of letters, words and sentences. This is followed by 'the second education' where pupils learn more complicated language use.

Socio-cultural view on learning

Socio-cultural theories of learning emphasize people as members of communities, where social interaction and the use of tools serve as a foundation for learning. People use tools to develop and change objects (L.S. Vygotsky, 1978). Aleksej N. Leontév (1978) developed a viewpoint that saw this activity as a collective undertaking. This foundation was expanded by Yrjö Engeström (1987) into a model where acting with tools was based on community interaction. The 'theory of activ-

ity' is seen as a development of Lev S. Vygotsky's theories of learning and part of socio-cultural theories. Activity develops both social and individual knowledge. Human activity is directed towards an object. The rules and the division of labour change the subject's actions with tools into an activity. Tools are to be understood as a mediating artefact. According to L.S. Vygotsky, language is the most important tool. He also described the connection between the child's drawing and their first attempts at writing (L.S. Vygotsky, 1987, pp. 107-108). The child formulates symbolic tools on a sheet of paper to point out objects (L.S. Vygotsky, 1987, pp. 110-114). This process is described as "the mediating role of gestures in defining the meaning of the first word" (L.S. Vygotsky, 1986, p. 64). L.S. Vygotsky's theories are central to the socio-cultural framework. Some basic parts of L.S. Vygotsky's socio-cultural theories which are relevant to the development of knowledge will be presented in this chapter.

Mediation

The concept of mediating is one of L.S. Vygotsky's main contributions to the field. The mediating triangle illustrates how people use tools to interpret context. The X represents a sign and can include both physical and mental tools. L.S. Vygotsky (1978, p. 30) expresses the illustrated mediating process as follows: "Consequently, the simple stimulus-response process is replaced by a complex, mediated act which we picture as":
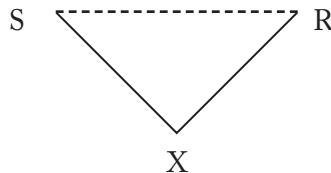
Figure 1. Mediating triangle
Source: L.S. Vygotsky, 1978.

The symbolic X changes the primitive behaviouristic stimuli and response model to an explanation of man's learning through the use of tools in interaction with environments. The mediating triangle provides an explanation of how human actions form the basis for understanding and learning as well as how thinking affects action.

Internalization and externalization

Lev S. Vygotsky describes the process of mediating as individual and also a function of collective human development: "[…] 'the social plane' transforms into 'the

psychological plane'" (1978). The description of the dialectic process of internalization and externalization theorizes how the individual interacts with the collective knowledge of a society through tools. Internalization is the process where humans adapt their collective knowledge and learn through their actions and become capable of developing their knowledge. The process of externalization explains how people act to realize their knowledge, ideas and creativity. Y. Engestrøm (2001) emphasizes the internalization and externalization process as a foundation of activity theory. He also contends that externalization is the main side of the contradiction of internalization and externalization – people's ability to create and act.

Zone of Proximal Development (ZPD)

The zone of proximal development is central to the theories of L.S. Vygotsky. G. Wells says: "There can be little doubt that, in the English-speaking world at least, it is the 'zone of proximal development' that has been Vygotsky's most important legacy to education" (1999, p. 313). L.S. Vygotsky formulates the concept of ZPD as follows.

> It is the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers (1978, p. 86).

There are different interpretations of how this concept should be understood. In its simplest form, the zone can be seen as a student's successful solving of a problem through the help of the teacher and cooperation by other experienced students. L.S. Vygotsky elaborates his view as follows.

> In child's development, on the contrary, imitation and instruction play a major role. They bring out the specifically human qualities of the mind and lead the child to new developmental levels. In learning to speak as in learning school subjects, imitation is indispensable. What the child can do in cooperation today he can do alone tomorrow. Therefore the only good kind of instruction is that which marches ahead of development and leads it; it must be aimed not so much at the ripe as at the ripening functions (1986, p. 188).

Gordon Wells links teaching in ZPD to the pupil's goals and tools. Education, teacher's instructions or cooperation among pupils in the zone of proximal development help students advance from spoken everyday concepts to writing and reading (1999, p. 314). Y. Engestrøm (2001) sees people's development in the ZPD as an interaction between social context and individual knowledge.

Learning

A socio-cultural view of learning focuses on activity, action, tools and community. Language is the basic tool. According to Roger Säljö, "the core of knowledge is speech and action in social context"(2000). G. Wells formulates the process of knowledge building as follows.

> Knowing starts with personal experience, which amplified by information, is transformed through knowledge building into understanding, where understanding is construed as knowing that is oriented to action of personal and social significance and to the continual enriching of the framework within which future experience will be interpreted (1999, p. 85).

Etienne Wenger points out the difference between information and knowledge: "Of course, availability of information is important in supporting learning. But information by itself, removed from forms of participation, is not knowledge" (1998, p. 220). Knowledge is personal yet built in a social setting. According to E. Wenger (1998), learning is a process of participation in communities of practice. This community of practice exists everywhere – and the important question is not *whether* participants learn, but *what* they learn (J. Lave and E. Wenger, 1991). G. Wells defines this knowledge building process as "appropriation through participation in activity"(1999). In this context, learning is seen as the participation in communities where the division of labour, rules and tools are a fundamental part of the learning process. According to L.S. Vygotsky (1986), learning should be a process in the zone of proximal development (ZPD) which favours learning processes that shift from the known to the unknown and where a more experienced student or a teacher can support the knowledge building of other students.

Case study

This study is a qualitative case study in accordance with the guidelines from John W Creswell (2007), Robert E. Stake (2010) and Robert K. Yin (2009), with a particular emphasis on the guiding principles of R.K. Yin, who describes a case as follows.

> In general, case studies are the preferred method when (a) 'how' and 'why' questions are being posed, (b) the investigations has little control over events, and (c) the focus is on a contemporary phenomenon within a real-life context (2009, p. 2).

A research design of a case study will usually include five components: "1) a study question, 2) its proposition, if any, 3) its unit(s) of analysis, 4) the logic linking the data to the propositions, and 5) the criteria for interpreting the findings" (R.K. Yin, 2009, p. 27).

It is possible to distinguish between four case study designs: single-case/holistic, multiple-case/holistic, single-case/embedded and multiple-case/embedded. All these basic designs for case studies have their own characteristics, with strengths and weaknesses. The basic difference is whether you have one or more cases, and whether you have one or more sources to investigate. The design for this case research is "embedded – single case design" (R.K. Yin, 2009, p. 39); that is one case, many sources. The research has been established on a case study concept which emphasizes a theoretical foundation: "[...] the better case studies are the ones in which the explanations have reflected some theoretically significant propositions" (R.K. Yin, 2009, p. 39).

A case study of the 'Writing to Read' concept

Nesna University College is located in a rural area in Norway near the Arctic Circle. The college's primary academic focus are different kinds of teacher training. One of the teacher training specializations is an one-year (60 credits) study of ICT and Learning, which is distributed on the Internet and organized through the learning management system (LMS) Moodle. The students are mostly teachers and student-teachers. ICT and Learning are built on work tasks and portfolio assessment. One of the assignments (2.5 credits) is to implement some of the writing to read strategy of A. Trageton (2003; 2010) in class. Teachers have the opportunity to implement this in their own class. Student-teachers have the possibility of testing elements or whole of the 'Writing to Read' strategy in their periods of in-service training. Teachers and student-teachers who have the opportunity to test this strategy choose timing and scope. After implementation, they deliver a report for guidance and a final assessment. In the meantime, the students have discussed their experience and raised questions in the LMS discussion forum.

The 'Writing to Read' programme has existed for four years and involved the students from the 2009/2010 and 2010/2011 academic years as the subjects of this case study. The class of 2008/2009 raised our curiosity and generated a pre-understanding. There are about 50 students who completed the course in each class. Approximately 20 of these students in each class were in a position to implement such a practical portfolio assessment. We are two researchers who are dedicated to this case study. One of us is responsible for the students portfolio assessment. This is a distant study course and the teachers do not meet the students face to face during the course. We have tried to avoid teacher-student situations which might produce bias.

Collecting the data

Robert K. Yin (2009) recommends that case studies use at least three sources of data. In this case, the sources are the teachers' and student-teachers' forum dis-

cussions in the LMS, portfolio reports and interviews with five respondents. The forum discussions developed as short responses and answers. Short forum-posts were toggled to other posts as a debate. Approximately 40 entries in the forum were submitted in each of the two classes. The posts in the forum were mostly delivered, while students and teachers worked on the task. As a part of the portfolio assessment, the students delivered relevant reports on the implementation of the 'Writing to Read' strategy. There were 22 relevant reports in the class of 2009/2010 and 21 in the class of 2010/2011. The portfolio assessment asked the teachers and student-teachers to develop this task in a classroom situation.

> Your assessment should develop a program for teaching according to Trageton's strategy of 'Writing to Read'. If desired, the task can be adapted to children outside of school. A suitable task describes your teaching program for 'Writing to Read'. You should evaluate your teaching program and the working process. You should describe how your evaluation has been accomplished. You should register obstacles as well as areas where the pupils are satisfied. It is recommended that you use a journal and document student contributions. You should describe the pupils learning outcomes. The document should be concluded with a reflection on your own working processes and learning outcomes. (The researchers have translated this and other citation from Norwegian to English).

The third source of data is five semi-structured interviews with teachers and students, who participated in this work task. Each interview was approximately 30 minutes long and had questions, which are of relevance to the categories of the case. Both men and women from different parts of the country were asked to be respondents and are represented. All interviews were done by the same researcher in 2012 and recorded and stored through Camtasia Relay.

Arne and Daniel are teachers working in two different schools in a town in the southern Norway. They cooperate within a programme in the first grade. The teaching took place during four weeks in the spring. They were teaching a group of eight pupils, who were 'lent' for this purpose. The teacher who was responsible for the class also participated. They divided the work and had different responsibilities. Arne and Daniel were interviewed through Skype at the beginning of March. Trine is teaching in a class of 26 pupils in a school with a total of 540 pupils in the eastern part of Norway. She tested A. Trageton's strategy on her own first-grade class for four hours a week for seven weeks in January and February. The interview took place through Skype in February. Hanne is a teacher in a second-grade class of 28 pupils in a town in northern Norway. She had tried a modified program of A. Trageton's strategies the year before in her first-grade class and wanted to continue with this strategy with the second year. She was interviewed on Skype in November. Solveig is a student-teacher who tried out A. Trageton's strategy in her in-service practice teaching in central Norway. Her third-grade class had 10 pupils,

a few of whom had special learning needs. Her in-service practice teaching was in the spring and she was interviewed in April. The interview was done face to face in a separate room on campus

Categories of teachers' and students' statements

We had certain expectations of this case, based on the experience of the class of 2008/2009. All the teachers and students who participated at that time were excited and reported good results and pupils' progress. Our intention is to verify that the participants are satisfied with the pupils' progress and that learning writing to read with digital tools is an effective strategy. We were also curious about the use of digital tools; how the pupils cooperate, the progress and learning, how the teachers and student-teachers fulfilled their work tasks in class and which strategies they employed. These questions, based on our impressions of teachers' and student-teachers' earlier work, have played an important role in the formation of our research questions and the categories for analyzing the teachers and students expressions. The research question is how do teachers and student-teachers develop 'Writing to Read' with digital tools?

We wanted to anchor this study in a theoretical framework suitable for these questions. The socio-cultural view on learning is another part of the formation of our questions and criteria for interpreting the findings. The categories of this study are based on the theories of L.S. Vygotsky. He focuses on the teaching and learning processes as they pertain to the 'zone of proximate development' and the processes of internalisation and externalisation (L.S. Vygotsky 1978; 1986). He recognizes mediating tools, community and cooperation as the foundations for learning. With this background, we found it favourable to link teachers' and student-teachers' statements to these categories:

- who are the pupils? (differences of age, situation and experiences);
- content and organization of the teaching program;
- pupils' learning processes;
- teachers' support;
- pupils' cooperation;
- the use of digital tools.

The categories were established from our case expectations and the theoretical framework. These categories are connected to the development of the 'Writing to Read' process and will be used to sort and analyze participants' statements. The categories of statements correspond to the discussions in the forum, the reflection in the portfolio assessment and the semi-structured interviews. These categories represent the criteria we used to analyze the data, and combined with the socio--cultural framework, interpret the findings. To assist in the validation of our data

and results, we turned to R.K. Yin's recommendation of finding and refining 'evidence from three sources'.

Analyzing the case

This case study covers primary school from the first to the fourth grade and includes classes consisting of some pupils with little knowledge of the Norwegian language. It also includes kindergarten children. In addition, some parents tested 'Writing to Read' on their own children or children they know well. The main focus of the study, however, is what G. Hekneby formulates as the 'first education in writing and reading' in the first and second grade (G. Hekneby, 2011).

The teachers' and students' report success

There were different teaching programs and situations for teaching the students. They varied from short lessons of 3 hours in one week to weekly programs which stretched over the entire year. Some of the participants tested 'Writing to Read' in accordance with A. Trageton's strategy. Others used elements of it and some combined the strategy with other methods and tools. This study focuses mainly on pupils in the first and the second grade – as 'the first education in writing and reading'. However, we also have comments and analyses that consider other groups and grades of children. It was a common experience for the participants to see progress in the pupils' work and to find the results to be satisfying overall. Many of the participants were surprised at the strategy's good results and said they would continue to use A. Trageton's approach. Karin, an experienced teacher in the first grade, says in her portfolio report (R1; quotations are numbered continuously and sources identified by: I for Interview, F for Forum and R for Report).

> After each lesson we, the two teachers, discussed how the pupils managed the tasks. We were both very surprised and impressed how well the pupils developed and how eager they were. Parents could also read the texts on the Internet, and they were very enthusiastic to see their first grade child be able to formulate meaningful words and sentences.

The use of the 'Writing to Read' strategy seemed to trigger enthusiasm among the participants.

In their interviews, the respondents confirmed the success of their teaching, which fulfilled the different goals for the students, as attested to in their assignments. The fulfilling of these goals can be summarised as follows:
- pupils recognized as many letters as expected or more;
- pupils wrote words and sentences as expected;
- some pupils broke the 'reading code';

- pupils produced letters, reading-books and newspapers;
- pupils increased the speed of reading;
- pupils combined writing and drawing;
- pupils participated in 'Process-Oriented Writing' and published products.

The teachers were also asked, as part of the portfolio assignment, to report problems they experienced. Some of the teachers said that in their school, and among the parents, there was little or no knowledge of the possible use of 'Writing to Read' on computers. Some respondents reported that there had been discussions in the media where this strategy was questioned. One problem that is focused upon in the media is the late (in the third grade) introduction of handwriting. The lack of knowledge, and some negative information, made it sometimes difficult to obtain cooperation and permission for its large scale implementation. This situation was discussed on forum. In her interview, Solveig agreed with other teachers that the successful result of 'Writing to Read' would make it easier to go on with the strategy later.

Teacher's guidance

The reports and the interviews describe teacher's guidance in the writing and reading process. The teacher organizes the teaching situation, usually pupils in pairs sharing a computer. The computers were prepared and the tasks and goals for the session were defined. In the first grade, the pupils often started by playing with the keyboard. With help from the teacher, this usually resulted in pupils writing lists of letters. Then the pupils with help from the teacher, printed lists of letters. The teacher often initiated the process by finding the first letter in the pupil's name. Some teachers reported that they discussed a situation and identified or formulated one of the written letters or a word and the pupils recognized and repeated it. Turid teaches the pupils from the first grade. She says in her report (R2):

> […] the students start playing on the keyboard. I visited five pairs of pupils during this lesson and showed them how to print. At the same time I talked with other pairs of pupils. I tried to organise the other pupils so they were busy, or there would be disturbances. I returned to each pair and continued the exercise. We looked for familiar letters and pronounced them loudly together.

Often the teacher would organize processes where pupils draw and illustrate on the printed outcome. Sometimes pupils use a paint program to illustrate on the computer screen and then print. Teachers collect the written results and make them public. This could sometimes be presented on posters or distributed to parents. Some teachers used the opportunity of publishing to read written words out loud together with the pupils. Teachers and pupils read sentences or stories from sheets or posters. Sometimes the pupils were asked to read their own written texts.

Cooperation

Reports from teachers emphasize the importance of teachers' support. They also describe the cooperation between pupils in pairs. The pupils' cooperation complements the teachers' support and, in some situations, makes the teachers' guidance unnecessary.

The teachers observe pupils who help each other find letters on the keyboard. Sometimes they look for special functions like the shift key and the size of the letters. Teachers also observe the students in pairs helping each other hunt for letters in the written letter lists. Meaningful discussions could be about correct spelling and identifying correct letters and words. Ann formulates another observation on the forum (F3): "We see pupils who in other situations have problems with behaving and cooperating, working happily together and helping each other solve problems". The pupils help each other with the reading of letters and, later in the process, meaningful words. Marit says in the report (R4):

> I try to mix the pairs – sometimes I try to have equal pupils in each pair, other times I try to have one skilled and one less skilled in the pair. But you never know, suddenly the less experienced pupil shows the skilled one how to do things on the keyboard or with the recognition of a word. In this project, it seems like individual differences can complement each other.

This kind of production and support in pairs is highly effective and gives a large amount of production results for each pupil. Teachers say that the interaction within the pairs of pupils gives access to more letters than one pupil can recognize. Nils in his report confirms that (R5): "[…] each pupil in the pair knows some letters and together they quickly nearly double it". Arne and Daniel said in their interview that the discussions among the paired students gave meaning and enthusiasm to the work. Teachers and students in the reports, interviews and forum space tell stories about the meaningful cooperation and enthusiasm the students showed working with computers.

Tools

According to socio-cultural theories, using tools is a fundamental part of the learning process. An important part of A. Trageton's 'Writing to Read' strategy is to introduce the computer as a tool in the learning process. Pupils use the computers to express letters, word, sentences and stories. Teachers say that computers seem to create motivation, enthusiasm and joy. Friends and family seem to find it interesting, when the children say that they work with computers at school. Small children are introduced to a new tool, which they master in the text production. Many younger pupils have motor problems with their handwriting, which prevents them from

taking full part in the traditional writing process. Arne says in the interview (I6): "Clearly those with bad motor, especially the boys in the first grade, can score high working on the keyboard. They do not have to see or write those ugly, curly letters." These children get experience dealing with the computer as a gateway to the writing community. It seems that the cooperative work on the computer makes each individual more productive. On forum Rune says (F7):

> […] it got to be well function computers, not to mention enough computers. Otherwise, it is too cumbersome. I have conducted a theme based station teaching. My goal was to increase reading speed of pupils. Objective 2 was to create text, lots of text. On average during this period (about 5 weeks) increased 21 of 23 his reading speed. Of course in the 3rd class so will any of this be normal development, but they increased quite a lot […] On average, the number of words written on the PC compared to hand written was approximately 150 words. Thus vocabulary increases and this in turn facilitates reading.

Rune summarized that computing and motivation gave good results. This stands in a contrast to the more traditional, individual pupils work with handwriting. The computer increases the speed of the work and the cooperation individualises the working process. Teacher and student-teachers summarized that the computer and cooperation were effective tools for each pupil in the production and problem solving.

A basic digital tool in the process of Writing to Read' is the printer. The computer is a tool, which the child uses to develop the letters and words and visualize it on the screen. The product should also be published by using a printer. When the letters and text are printed, it opens the door for further processing. Printed sheets of paper were pinned to the wall or collected in the pupils' books. The printed product may be a basis for drawing, speech and reading. Marit says in her report (R8): "One day we were without a printer, and the writing process seemed less important and meaningful".

Arne Trageton's concept emphasizes the students as producers, not children as consumers. The computer in the 'Writing to Read' strategy develops the pupils' ability to produce by writing. The pupils' pronunciation of written letters, words or sentences is a successor to the writing. The writing usually gives the opportunity for further publicity. Printed words can be combined with drawings and published as posters on the wall. Trine comments on publishing of this type in her interview (I9): "The pupils were very proud of what they had produced, so we collected the words and sentences together with their drawings, as a big poster. We put the poster in the corridor outside the classroom." Such digital publishing is usually meant for the classroom, but can be published in the public areas of the school and even distributed to the pupils' homes.

Another tool, which teachers reported as important in the publicity work, is the learning management system (LMS), usually 'Fronter' or 'It's learning'. These systems make it possible to distribute the pupils' texts, pictures and drawings internally in the class or externally to the rest of the school or to the pupils' home. Kristian says in his report (R10): "Parents ask me what is happening in school because their child is looking so much forward to these lessons. Then I got the idea to distribute the written products on 'It's learning'". The use of the LMS opens a new way to cooperate with the parents. The pupils' digital products are well suited to be distributed at home to proud parents.

Digital tools, however, are also sometimes connected with problems. The teachers and students were asked to report problems and 'bottlenecks' in their work as part of the portfolio assignment. The following is a list of the most frequently reported problems linked to the use of digital tools:

– writing functions connected to the text editor;
– saving and locating files;
– printer connection;
– connection with the LMS;
– access to computers – in some schools, the lowest grade had low priority and access;
– access to net – passwords and user names can represent problems for low age pupils;
– locating computers in the classroom – computing is reserved to data room;
– computers malfunction due to mechanical problems.

According to international studies (ITU Monitor, 2009), Norway is one of the best-equipped countries in the world when it comes to digital tools. This can indicate that some of the problems are connected with a lack of competence with computers in the school.

The teachers' and student-teachers' experience with the digital tools that helped develop the pupils' ability for 'Writing to Read' can be summed up as follows:

– pupils' cooperation and teachers' guidance;
– motivation and joy;
– pupils own keyboard writing, and reading their own writing;
– connections between drawing and writing;
– motor control;
– increased speed and production;
– print-outs for reading;
– print-outs for publishing;
– connection to the pupils' home through LMS.

Understanding 'Writing to Read'

The socio-cultural framework, which this study is anchored in, together with the teachers' and students' experience, is meant to develop an understanding of the 'Writing to Read' processes. Learning is participation (E. Wenger, 1998), and acting with tools in communities (Y. Engeström, 2001). The most important tool is language. Tools mediate knowledge as learning processes in the zone of proximate development (L.S. Vygotsky, 1986). Humans interact within context, in dialectic processes, where processes of adaption (internalization) and external acting (externalization) are central.

The stories told in the teachers' and students' reports, interviews and on the forum are about the pupils' knowledge building in the zone of proximate development. Teachers and students tell about the process of initiating written lists of letters and the follow up of the writing of words, sentences and texts. Turid (R2) describes how she organises and supports hunts for and the reading of letters and words together with the pupils. The students are organized in pairs and work together in the zone of proximate development. In this zone, the pupils support each other in the work with letters and texts. The most skilled pupil supports the other. Marit (R4) also describes how the position as the most skilled can change many times during the work processes with the computer.

The pupils use the computer as a tool when they participate in the 'Writing to Read' process. Rune (F7) describes results of interacting with the computers when the pupils write and read. Writing on the computer increased the speed of reading and developed internal reading skills. This process also strengthened the externalized writing process of meaningful words and sentences. The computer and the printer are the tools that mediate the meaning of language. These expressions can be the first letter in a pupil's name, their whole name and/or texts where the pupils relate what is going on. Their knowledge is constructed in interaction with the context when they are writing. Their own written letters on the screen give the opportunity to start reading more familiar material and, with help, partly unknown words. Their written letters and words texts are printed and published with tools. Trine (I9) points out the importance of publishing the written words. Digital tools support these processes and even give access to support from home.

Conclusion

The teachers and student-teachers developed A. Trageton's concept of 'Writing to Read' with digital tools under various conditions. Teachers and student-teachers prepared different strategies of organizing different groups of pupils. It included children from kindergarten to the fourth grade pupils in primary school. It in-

cluded children with disabilities and foreign origin. It was implemented over different time periods and in classes and groups of large or small size. The tools were different. There were new or old computers, which were part of networks or standing alone. Computers could be connected to printers and LMS systems or not. Different programs for text production were employed. Some of the pupils broke the reading code, while others did not, although they did experience other forms of progress. In spite of the differences, all teachers reported that the 'Writing to Read' concept works. Pupils gained the knowledge and skills as expected and frequently exceeded those expectations. This tells us that the concept of 'Writing to Read' can be implemented under different conditions. 'Writing to Read' can be a main strategy of teaching, but it can also support other methods and strategies. Teachers and students report the successful use of 'Writing to Read' as one of many approaches that can be mixed with other methods.

This study shows that the 'Writing to Read' strategy is anchored in traditional and well-documented socio-cultural positions. These positions are the zone of proximal development, the use of mediating tools, and the processes described as internalizing and externalizing, with focus on externalizing. Other successful methods of learning to read and write can be positioned inside the same framework. A combination of the two mainstream methods used in Norwegian schools – the 'phonetic' and 'whole language/ methods – together with 'Writing to Read' is reported as a useful mixture of methods.

In spite of the similarities in methods, in our study there are differences which make this concept of 'Writing to Read' unique at this time. This 'Writing to Read' strategy uses digital tools. The writing process is anchored in the use of computers. Pupils interact with the computer screen in the writing process. The printer is a tool for systematic publishing and for further work. The LMS can connect the pupils' digital products to their home and can open new gates for interaction and support. The use of digital tools in this case represents basic conditions in the support and the development of pupils' expression.

Cooperation is promoted by organizing the pupils in pairs for the computer work. This cooperation also supports individual growth and the mastering of the 'Writing to Read' strategy. This way of working is a counterpart to individualised handwriting. The use of a computer and printer motivates and inspires the pupils in their use of the 'Writing to Read' concept.

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