



## Improving literacy skills through learning reading by writing: The iWTR method presented and tested

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### ABSTRACT

Learning to read and write is a basic skill that unfortunately not everybody acquires sufficiently. Lack of teachers and time in school are some of the reasons, but in addition the enormous rise in informational activities due to the Internet and other information technology-enabled opportunities has made literacy skills increasingly important to ever more people. This means literacy education must be improved so more children in the world get better chances. In order to contribute to developing better methods for learning to read and write in early years this study tests a new method developed to improve reading and writing learning in early ages. The ICT (Information and communication technologies) supported “Integrated Write to Learn” (iWTR) method lets children in 1st grade use computers and other ICT tools to write texts and subsequently discuss and refine them together with class mates and teachers. Handwriting is postponed to 2nd grade. While the traditional method requires students to go through two development processes in parallel, a cognitive (learning to read and) a motor (learning to write with a pencil), iWTR works with one process at a time, first cognitive development, then (from grade 2) motor skills training. iWTR extends previous WTR methods by more social work methods using a web site and peer comment for providing social meaning and feedback.

The method was tested using two test groups and two control groups (total  $n = 87$ ) by systematically measuring performance in reading and writing using standard tests in combination with observations and student evaluation to assess social and individual effects of work methods.

The results show that while reading skills were improved considerably the biggest improvement concerned writing skills. Students in the test group wrote longer texts with better structure, clearer content, and a more elaborate language.

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## 1. Introduction

Learning to read and write is a basic skill that unfortunately not all children in the world learn sufficiently. In a time when societal change puts increasing demands on individuals' competence in using written language it is important that schools are able to teach such skills to all children. In many countries major problems include too little time spent in school and lack of teachers. But even in countries where children go to school many years and have teachers there are problems. The “information society” in practice means a huge rise in informational activities due to the internet and other ICT (information and communication technology) related activities. More people in the world need enhanced literacy skills to be able to find, select, interpret, analyze, and produce information.

The PIRLS international benchmark on literacy includes four levels, *low* (locate and retrieve information), *intermediate* (make straightforward references), *high* (make inferences and interpretations with text-based support), and *advanced* (integrate ideas and information across texts to provide reasons and explanations) Mullis, Martin, Foy, & Drucker, 2012). The information society requires that more people acquire skills towards the high end of this scale. In Mullis et al. (2012) benchmark, even the highest performing countries only barely achieve a score of 20% in the “advanced” category (Mullis et al., 2012) and just over 60% in the “high” category. So in every country, improvement in literacy skills is important.

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Early age learning is crucial; earlier research shows that children who lag behind in early years' reading and writing development encounter considerable difficulties in following education later on as texts get longer and more complicated (Myrberg, 2007).

Given this situation, there is a need for better methods for literacy development. Drawing on a critical social practice view of literacy this project has developed such a method based on a social view of learning and ICT use. This paper describes the method and its rationale, and presents results from a quasi experiment test involving 87 first grade students in Sweden.

## 2. Background: literacy and ICT

### 2.1. Literacy research

There is comprehensive research on reading and writing skills, and there are various theoretical perspectives. Early literacy research was often characterized by a cognitive focus and a technology-deterministic perspective (Berge, 2004) in which a leading idea is that writing technology directly determines people's thinking (Ong, 1982). A more recent view is socio-culturally anchored, emphasizing the social, cultural, and historic situation of language (Barton, 2001; Street, 1984). This strand of literacy research is fundamental to this study. In a socio-cultural perspective, learning takes place in formal as well as informal contexts, and important aspects of learning include use of tools and development of artifacts (Säljö, 2000, 2002). This perspective urges teachers to work with children's phonological awareness in a structured way, taking the starting point in the children's experiences, creativity, and interests (Frederickson, 2002; Liberg, 2006). Luke and Peter (1997) add the dimension of critical thinking; reading then is about engaging in, reshaping, and critically examining the ways in which the world is described. Reading and writing are culturally defined social activities. There are always underlying purposes and relations, texts are not neutral. We learn reading and writing through social relations, with parents, teachers, friends, media, etc. The view of oneself is constructed by institutionalized reading practices. Texts always represent values and views. In this perspective literacy activities in the classroom become crucial. Following this perspective, the "Four literacy resources model" (Luke and Peter, 1997) specifies a set of practices that children need to participate in so as to develop into good readers;

- Breaking the code of written texts;
- Participating in understanding and composing meaningful written, visual and spoken texts;
- Using texts functionally;
- Critically analyzing and transforming texts.

### 2.2. Computer use and "write to read" research

Computers have been used in Swedish schools since 1984 when the Swedish "school computer" Compis was introduced. Later, in the 1990s a national effort put more, and more powerful, computers in the schools (Jedeskog, 2000). Various pedagogical uses have been discussed, including for early reading and writing. However, all the early trials to the overwhelming part used computers in labs, which made use complicated and time-consuming (Hylén, 2010). It is not until the past very few years that "one-to-one" computing (1:1), one computer per child, has spread across Sweden, following an international trend. Today, more than 200 out of the 290 Swedish municipalities have subscribed to the 1:1 concept (DiU, 2012). This means that computer use in the classroom changes as the tool is available, ready to use, at any time. Also, children today are experienced computer users already when they start school, which they were not during the 1980s and 90s trials. (Findahl, 2010) finds that the "Internet beginner age", defined as the youngest age at which more than 50% use the Internet, was by 2009 as low as 4 years, down from 13 by year 2000. While these numbers are from Sweden, a similar development can be found in other countries (The Findahl study involves 22 countries). Pedagogical innovation therefore faces new opportunities.

In 1984 a computer-assisted "Write To Read" (WTR) program was designed and tested in a number of US schools over the following decade. Results were mixed; some schools achieved good results, others not. One reason for the limited success was that WTR programs were not completely implemented in all schools so the evaluation rests on incomplete data (Slavin, 1991). Comparison over time is also difficult as technology has changed, as has skills in computer use. Early test used computer labs, which meant children were taken out of their everyday work practices in the classroom. This limited the amount of time available for the program. It also made it difficult to see effects of the computer use as the children also learned reading and writing in traditional ways in the classroom. Partly for practical reasons, the early WTR trials emphasized individual training at the expense of the social aspects of learning – students were working alone at the computer separated from the social activities in the classroom, like discussing letters, words, and texts with teacher and peers, which are considered crucial in socio-cultural perspective on learning. Today's trials use portable computers or tablets (for example, iPads) and web sites integrated in everyday classroom activities. Contemporary WTR trials report positive long-term effects – improved results during later school years (Trageton, 2003) – but studies often suffer from lack of research rigor.

A factor that is underresearched in WTR research, and indeed in many studies of ICT use, is the importance of social interaction. Recent research on social interaction in combination with ICT use finds that the effect of ICT tools is mediated through the "right use", i.e. the setup of the social interaction in which the tool is used. The tool itself has no direct influence on learning but lends itself to both positive and negative outcomes depending on how it is used (Eagle, 2011; Joubert & Wishart, 2011).

Drawing on a critical social practice view of literacy this project has developed the method further to include a social view of learning. The project is a small-scale pilot study taking its empirical material from the Swedish city Sollentuna where teachers have further developed the WTR concept into the "iWTR" (Integrated Write To Read) method and used it in two classes. "Integrated" means that reading and writing are integrated within the classroom, within a social learning process, and across school subjects. Children cooperate pairwise producing texts, using keyboard, which are then published on a class web site and subjected to discussion among students, teachers, and parents, and subsequently refined in joint efforts. This means all writing has a purpose and an audience, and texts are not static but further developed based on discussions. Speech technology is used to check that the writing produces the desired sound, thus providing direct response to the children's spelling.

### 3. Purpose

The overall aim of this research was to contribute to developing better methods for learning to read and write in early years. We do so by testing a new method in two first grade classes, with another two serving as control group. The ICT supported iWTR method lets children in 1st grade use computers and other ICT tools to write texts and subsequently discuss and refine them together with other children and teachers. Handwriting is mainly postponed to 2nd grade. The traditional method requires students to go through two development processes in parallel, a cognitive (learning to read and) a motor (learning to write with a pencil). iWTR works with one process at a time, first cognitive development, then (from grade 2, or earlier depending on the literacy development of the pupils) the motor one. The hypothesis (H1) is that this sequencing of two, each fairly complicated, development processes will make it easier for all children, but in particular those with slower motor development (or other difficulties concerning reading and writing) to develop reading and writing skills over the period of the first school year (we also hypothesize positive effects later in life as reading and writing are skills that are fundamental to other learning, but investigating that is not part of this article). Throughout this project the students continuously were to practise fine motor skills in many different ways so that when starting writing texts with a pencil they have already improved their fine motor skills which facilitates learning writing.

A second hypothesis (H2) is that ICT tools can improve performance during the process of learning reading and writing. Such tools include not just the obvious keyboard, without which writing at early age is impossible, but also speech technology and web places (here Google docs, for sharing texts and discussions), which all in different ways can support various steps in the process.

A third hypothesis (H3) is that a social writing process involving children in cooperative development is conducive to learning.

The aim of the project was therefore to investigate the following questions

*RQ1:* Does the iWTR method improve children's skills in reading and writing?

*RQ2:* What teaching factors are essential in order to make the integration of ICT and the students' literacy development as favorable as possible for the student's reading and writing capabilities?

RQ 1 corresponds to H1, and is answered by systematically measuring performance in reading and writing using standard tests, developed and/or recommended by the Swedish Board of Education (Skolverket).

RQ 2 is answered by observing classes and evaluating work together with students over the project period to see how the method used is received by students. RQ2 corresponds to, but is not limited to, both H2 and H3 which suggest, respectively, that ICT tools and social environment are such essential conducive factors.

### 4. Method

The test group comprised of two 1st grade classes in Sollentuna, Sweden, were using the iWTR method (described in Section 4) and two other 1st grade classes at the same school were used as control group. The test group included 41 students, the control group 46. The children were 7 years old.

The study was a quasi experiment. We could not recruit students on a random basis but had to use existing classes. The choice of school was also not an option as the method was developed and tested by a specific teacher and employed equipment specifically bought by that school, and hence had to be tested in that particular school. Despite of these restrictions the four classes used are comparable by all reasonable estimates. We included all students in all grade 1 classes in the school. They all come from the same residential area. As Table 1 shows, the gender distribution was fairly even, as was the group sizes.

Regarding the individual students' problems of various kinds, motor, general development or other, there are no strict measurements regularly made at the start of the semester at the school. Students are observed and assessed by teachers based on experience. The fairly large number of students (87) and the fact that students come from the same limited geographical area within the city suggests that a normal distribution of such problems can be reasonably assumed. This was also the conclusion of the teachers involved in the assessment of these students – the classes were all considered being normal in this respect.

The test period was one school year, from August 2010 to June 2011. In total three teachers worked with the test group. The teachers had a total of 20 computers which were shared among the classes. In the control group there was no intervention. Teaching was done as usual.

There was no specific teacher training before the project. The teachers read some WTR literature and discussed among themselves how to set up the project.

#### 4.1. Case design

The trial was one part of the efforts of the City of Sollentuna to develop new work methods aiming at fulfilling the requirements of the new national curriculum (Lgr 11) as well as Sollentuna's stated purpose to become the best city in Sweden when it comes to education.

**Table 1**  
Gender distribution and group sizes.

	Boys	Girls
Test group 1	12	8
Test group 2	9	12
Total test	<b>21</b>	<b>20</b>
Control group 1	12	12
Control group 2	12	10
Total control	<b>24</b>	<b>22</b>

Apart from separating motor training from the work of learning to read and write, iWTR involves an extended – as compared to earlier WTR models as well as to traditional methods – social process. This means not only that students cooperate more and differently, but also that all writing the children do has a purpose and an audience. Topics were chosen among issues which were at the focus of children's interest at that time. That might be some world news, some local event, or something from the latest book the teacher had read for them. Speech technology was used to check that the writing produced the desired sound, i.e. to provide direct response to the children's spelling.

iWTR starts with students writing texts themselves from the outset. This creates a pre-understanding for reading (because they know what they want to tell). The keyboard helps them produce letters, which also are more easily read than hand-written letters made by beginners – an important point when it comes to presenting the texts to other children – and speech synthesis helps them understand when they got the letters right, as the right sound will then be produced. This way the time for reading and writing learning in 1st grade is clearly focused on the cognitive development; decoding of letters and sounds, the ability to formulate oneself in writing, reading the texts written by peers and responding to them in writing.

Training of hand writing is postponed to 2nd grade. At that time, students are already familiar with letters, their sounds, and their combination into words. Hence training of hand writing is not confused with the process of learning to combine letters into words and sentences. It is an ability in its own, trained for its own purpose. This is not to say, of course, that hand writing training is not worthwhile. The point to be made is that the process of understanding letters and writing them are separated so as to facilitate learning.

Initially, the students undertook some training in computer handling, such as logging in, learning the personal login code, finding the symbols for different programs, opening a document in Microsoft Word, starting the "talking keyboard", and writing some simple words just to learn how to do it on the computer.

When that was done satisfactorily, the actual reading and writing training began. Students worked in half-class groups (on average 11 students) with producing texts at least one hour every day. The tasks varied and different text genres were used. Students worked in pairs where one student spoke what was to be written and the other typed on the keyboard. The two roles were taken intermittently by the two. As skill in writing improved, students were increasingly allowed to work alone if the pairwise cooperation was felt limiting, e.g. by slowing writing down.

#### 4.2. The iWTR method

The iWTR method is based on the goals of the Swedish National curriculum (Lgr 11), and it uses active writing, publishing, peer feedback and formative assessment as main distinctive components. Supporting components include inspiration and preunderstanding, text genres, and writing strategies. Fig. 1 illustrates the general work process by which lessons were carried out in the project.

1. First, the teacher planned the lessons by choosing which *abilities*, *core content*, and *knowledge requirements*, in accordance with the curriculum (Lgr 11), that was the aim of the lessons planned. It was important that the teacher helped the students understand what they were aiming at. The goals of the work were clearly specified and documented on the classroom wall.
2. Second, the teacher was to inspire the students in conjunction with setting the topic. At the same time the teacher was to give the students examples from the genre to be produced in order to create a preunderstanding among the students.
3. Before the students began writing it was important to give them knowledge concerning how that particular text genre was to be written. For example, what kind of words are suitable to use, who is the receiver of the text, etc.
4. After making this introduction the students began writing while getting linguistic support from the teacher and feedback from both their peers and the teacher.



Fig. 1. The iWTR method. Lgr 11 is the Swedish National curriculum.

**Table 2**  
Results on H4 test (number of words correctly read in one minute).

Total number of students: 87	% of students scoring >35 words/minute (pass level)	% of students scoring >55 words/minute
Test group (41 students)	87.8%	56%
Control group (46 students)	84.7%	36%

- Depending on topic and type of assignment the texts were either written and published directly on the class web site or written in a document shared with teachers and peers, two ways to make communication and feedback possible during the writing phase. Either way, after the texts were published different kinds of feedback from the receivers was mandatory. The purpose was to make sure the students knew that they were writing for real receivers, and that they would get written feedback directly after publishing their texts.
- Finally, some kind of formative assessment by the teacher and the students were made.

In parallel to the writing activities, reading was on the daily agenda. Instead of a text book, books were chosen from the library by teacher and students jointly. The purpose was to create an interest for different authors, books, and genres. Students who beside the daily work of writing texts on computers also wanted to produce handwritten texts were of course allowed to do this as well.

The students' texts were published on a class site, built in Google docs (the name at that time). The purpose was to make sure texts were read by others, primarily the other students and teachers, but also by parents. This served to increase the students' awareness of an audience and to make sure there were responses to the texts.

#### 4.3. Data collection

At the start of the Fall semester in grade 1, students' linguistic ability was assessed using the National School Board (NSB, Skolverket) assessment guidelines (Skolverket, 2010). At the end of the Spring semester results were assessed by the same method, but also by a quantified reading test named H4, which measures how many words a student can read correctly in one minute, and by analyzing texts from the test group and the control group, again using NSB guidelines (Skolverket, 2012).

The H4 test was conducted at the end of the Spring semester in grade 1 for the test group but at the beginning of the Fall semester in the control group. The reason was practical: the test is usually done at the start of the Fall semester but we tested at the end of the Spring semester in the test group as we wanted to make sure not to miss any student – some might change school over the summer. This should be to the disadvantage of the test group as reading skills improve also during the summer – children at this age are really personally interested in learning to read and write – so the test results should be rather on the conservative side. The test group would likely have scored even better had they been tested in the Fall.

The student-produced texts were analyzed for content, length and form (grammar and expression).

## 5. Results

As concerns reading skills, Table 2 shows that the percentage of students who achieved the “pass” level – reading at least 35 words per minute – was slightly higher in the test group than in the control group. The main difference is concerning the high performers scoring 55 or above. While 36% of the control group achieved that, in the test group the share was 56%.

This means that in the test group there were more excellent readers than in the control group.

**Table 3**  
Example conversation about a riddle.

Student texts	Authors' translation (with corrected spelling)
Gåta: Vad är jag? • jag är liten • jag har en knåp på rumpan • jag är smal • du har många hemma • jag finns i många färger • den har en kork av Viktor och Marcus Kommentarer William: jag tror att den ör en knap på byxorna Filippa: jag tror att de är en kopp Josefine: jag tror att det är en pena Isac: jag tror pena Jonas: Jag tror att det är en tus-pena. Saga: jag tror att det är en pena men eran var väldigt svår Ellen: Jag tror pena eller en pet flaska Ben: de e en tusk-pena Lukas: synd att viktor avslöjade det är en turs – pena Iris: törspena Viktor: det retta svaret är turs-pena	Riddle: What am I? • I am small • I have a bud on by butt • I am thin • You have a lot at home • I exist in many colors • It has a lid By Viktor and Marcus Comments William: I think it is a button in the trousers Filippa: I think it is a cup Josefine: I think it is a pen Isac: I think pen Jonas: I think it is an indian ink pen Saga: I think it is a pen but your riddle was very difficult Ellen: I think pen or pet bottle Ben: It is an indian ink pen Lukas: Too bad that Viktor disclosed that it is an indian ink pen Iris: Indian ink pen Viktor: The correct answer is indian ink pen



As concerns writing skills, we found that the texts produced in the test group were (much) longer, they had a clearer story with a more logical flow of events described than the control group students. According to the teachers' assessment, a majority of the students in the test group had already at the end of grade 1 achieved writing skills required by the national tests to be taken in grade 3. This was not formally tested, so it remains an assessment based on experience.

Student texts were assessed using the national goals and requirements from Lgr 11 concerning the grade 3 national test (Skolverket, 2011). Importantly, also students with lesser literacy skill performed well in the test. For example, a student with suspected (but at the time not formally diagnosed) dyslexia managed to produce a 359-word perfectly readable text. A normal performer would produce a text at around 700 words, while an excellent performer produced a 2319-word story.

No strict comparison (e.g. on vocabulary, grammar, word count etc.) with texts produced in the control group was meaningful as there simply were no comparable texts from that group, they were so short that they did not really qualify as "stories".

Regarding the social interaction part there were huge differences compared to the traditional group. In both groups texts were read out loud to the class when they were finished. However, in the test group there was a lot of interaction also during the production of texts, and also interaction in general in writing rather than oral. The test group students commented on each others texts online, and made improvements subsequently. There were also discussions going on online, in writing, about other things. For example, students would present riddles for the others to solve. These activities led to not just to direct improvements on the stories the children were writing but generally to much more writing and reading being done, leading to general literacy improvement. Solving riddles would normally be an oral activity in grade 1. The excerpt in Table 3 is a discussion of a riddle on the class web site.

## 6. Discussion and conclusion

We started out with three hypotheses, that the iWTR method would lead to better reading and writing skills (H1), and that ICT tools (H2) and a well designed social environment including peer feedback (H3) would be instrumental to achieving those results. While the size of the test group is fairly small and hence far-reaching conclusions cannot be made, the results of this trial are clearly encouraging.

The tests show that both reading and writing skills had improved considerably in the test group; H1 is hence supported. Also, student satisfaction – as reported by students in comments on the web site and in talks with the teachers, was high, both as concerns method and results. By the end of grade 1, all students in the test group, irrespective of whatever difficulties they had had, were assessed by the teachers as having good confidence in their reading and writing improvement. They had all published their texts, all equally good-looking in terms of the visual appearance, irrespective of the level of motor development of the child. Nobody had had to erase mistakes on paper resulting in wrinkled and miscolored paper, missing words squeezed into too small spaces etc.

We believe that the good results can to a part be explained by the technology used, to a part by the social arrangements, but in particular by the two together. Clearly the technology has helped as motor skills do not make so much of a difference when using a keyboard as compared to writing letters with a pencil. On a computer screen, everybody's letters are just as good looking and therefore more easily to be read by other students. Also the students who yet not were able to read could participate completely in all kind of communication between the classmates by using the speech technology to read the different texts and be able to write feedback to their classmates. We believe that the fact that all the students, regardless of their different level of development concerning reading and writing, due to technology have published their texts, commented on each others texts, and made improvements subsequently have made an important difference. This is also what students report in their assessment of the work. Hence, H2 is supported.

The social process increased motivation but also improved students' understanding of how other people receive their texts, i.e. the social nature of language has been more clear to them during the process of producing the texts. The texts have all been used to communicate with peers, they have not just been a task assigned which the teacher will later check and correct. This was made practically possible by the implementation of the class website where texts could be easily accessed, commented upon in writing, and subsequently revised and improved. Also children who for various reasons not would have been able to produce a readable text with pencil and paper have been able to do so using keyboard and speech technology. This means that every student has been visible and read on the web. Students have been able to read their peers' comments over and over again. This written feedback proved to be very important for everybody, but in particular for those who had difficulties in reading and writing. Ever so often, precisely those students went back to old texts, read their friends' comments and gained in self confidence.

This interpretation of the reasons for success is in line with the findings in Hattie's (2009) large-scale study, which emphasizes students' knowledge of the goals, feedback concerning the performance of the student, the pedagogical ability of the teacher, and the support and encouragement from home (Hattie, 2009).

Regarding the measurement tools used, the mix of quantitative and qualitative assessment made it possible to compare results on the quantitative measures (reading speed) as well as the qualitative ones (quality of texts produced). The tools used are also approved and recommended by the national board of education and increasingly used in Swedish schools, which means they are the currently most reasonable tools for comparison.

During the project work we incidentally discovered that the method can be used also in other contexts than learning reading and writing. While we were pursuing the project reported here another teacher at the school became interested and tried a similar work method in mathematics. The web site was used to communicate about the maths assignments with peers and teachers. The crucial point turned out to be this communication, the way the mathematical problems were explained and discussed. Earlier, this kind of "maths stories" were posted on the classroom walls on paper and not much further discussed among students. Not only did the web site lead to more communication among students, it was also important that this communication was preserved and hence more open to teacher inspection and interpretation than before. This meant that on top of the increased communication, the teachers were able to provide more accurate feedback as the childrens' reasoning was more clear to them, and indeed to the students themselves who had spent more effort writing it down. Also, this communication can more easily be communicated to parents at the annual individual development plan meetings. This is of course only anecdotal evidence but opens up interesting opportunities for further research and development.

This paper has reported a small-scale study. The study contributes to practice by providing an innovative, theory-based method for literacy development and some empirical evidence for its effectiveness. The contribution to research is to show, by means of a structured test, the importance of a conducive social context for making good use of ICT. Further research includes a larger study comprising eight schools in City of Sollentuna using the same method and measurement tools.

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