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Writing practices on tablets with speech synthesis in grade 1 and 2

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ABSTRACT

The use of one-to-one tablets in literacy education is significant and increasing. This study investigates what 36 grade 1 and 2 students do when they write on tablets with speech synthesis pronouncing what the students write. We observed their writing and explored the motivations for their actions by analyzing video recordings, screen recordings, and students' texts in light of three concepts from self-determination theory: competence, autonomy, and relatedness. Our results showed silent classrooms in which students seemed engaged in writing. The speech synthesis function leads to a considerable focus on orthography. Moreover, students competed on text length, showed digital tricks to peers, and wrote profanities. These actions are understood as a part of the students' autonomy and relatedness with peers.

1. Introduction

The use of one-to-one (1:1) digital devices in school is rapidly increasing. Technical competence is seen as one of the key competences for a successful life and a well-functioning society (OECD, 2005). The UNESCO-program Education 2030, which advocates inclusive, equitable, and quality education for all, emphasizes the importance of ICT in promoting literacy and numeracy skills (UNESCO, 2015). One way to enhance digital and literacy competence is to introduce 1:1 tablets in the first years of schooling as the main mediating learning resource. The Norwegian government has initiated a large-scale program to buy hardware, especially tablets in primary school and computers in high school (Udir, 2019). It is estimated that about 50 % of students in the first years of schooling have a 1:1 device, and the number is rapidly increasing (FIKS, 2019).

Research related to the use of 1:1 tablets in the first years of schooling shows a large variation in terms of academic outcomes (Berrum et al., 2017; Dahlström & Boström, 2017; Mangen & Velay, 2010). However, one of the consistent and reported findings is enhanced student motivation (Couse & Chen, 2010; Flewitt et al., 2015; Zhu et al., 2018). It is often claimed that young students benefit from digital writing, whereby the students do not have to actively form the letters themselves; they can identify the letter and press the right key (Genlott & Grönlund, 2013). In the Nordic countries, Trageton (2003) has been a pioneer within the paradigm writing-to-read using digital tools from day one in school. As a result, applications for writing with speech synthesis have been developed in Norwegian, Swedish, Danish, and English (IntoWords, 2019; Ohlis, 2019). The majority of the students using tablets in

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literacy education use applications with speech synthesis (Berrum et al., 2017). The speech synthesis pronounces each letter in the writing process; it forms words from the letters and reads the entire sentence once the period is typed. Thus, unexperienced readers can have their writing read aloud through their headset, which provides immediate feedback on the letter and corresponding sound.

Since this massive paradigm shift from the pencil to tablet seems to circle around the term “motivation”, it is of paramount importance to scrutinize what lies in this term and behind the students’ choices (Koh, 2020). By examining what draws the students’ attention as they are writing, we strive to understand better what may motivate young students in their early experiences with writing on tablets with speech synthesis. The student perspective in the digital environment can shed light on what characterizes the writing practices of these students (Blikstad-Balas, 2012). In order to study young students during writing, in the larger classroom setting, we ask the following questions:

- 1 *What are students doing when they interact individually with tablets with speech synthesis in the initial literacy education?*
- 2 *What seems to motivate the students’ actions during the writing events?*

In this classroom study, where students’ individual writing on tablets is explored, we argue that these students’ actions when they work alone can be understood as an example of their self-determination. The analytical framework is, thus, based on three main concepts from self-determination theory: competence, autonomy, and relatedness (Ryan & Deci, 2002). Unlike other motivation theories, self-determination theory addresses the issues of energy and behavior, not only goals and outcomes (Deci et al., 1991). These terms are further operationalized in the methods section, as they are the categories used in the analysis. We differentiate our understand of “motivation” within the writing event from three affiliated understandings of “motivation” connected to writing. First, we discern our understanding from what the teacher does to motivate for writing, as presenting a meaningful context (Chen, 2013; Darrington & Dousay, 2015). Second, we segregate our understanding from the writers’ motivation to write or not to write (Hind & Pietro, 2006; Troia et al., 2012). Third, we discrete from the behaviorist perspective of operational motivation (Michael, 1982) within digital platforms, such as stars, encouraging words, and animated figures for instruction (Daniels, 2017).

2. The Norwegian context

In Norway, students start school when they turn six. According to the national curriculum, students are expected to produce sentences and write simple stories after second grade, and this mirror the practice (Hagtvet, 2017). There is no formal demand to master orthography during the first four years of schooling. Norwegian is largely a phonetic language and is often described as semitransparent. It has a high degree of correspondence between sound and letters, compared to, for instance, English. This makes the language suitable for using writing with speech synthesis.

3. Earlier research

The “writing to read” approach occurs both in digital and non-digital environments, but has experienced significant growth within the digital paradigm since its introduction by Trageton (2003). In this review, we present prior research concerning writing with digital tools, especially tablets with speech synthesis, within the first years of schooling. We exclude discussions about handwriting vs. typing from neuroscience and cognitive perspectives (Mangen, 2016; Wollscheid et al., 2016). Even though the research on implementation of tablets is fragmented and in an early phase, we still see some tendencies of approach to research and findings. Studies find that students seem motivated by using tablets in general (Pruet et al., 2016; Zhu et al., 2018), and in relation to literacy (Couse & Chen, 2010; Flewitt et al., 2015; Hatherly & Chapman, 2013). Despite this, some studies report student anxiety about not mastering the digital competences required (Thorvaldsen et al., 2011). Thus, students’ feelings connected to the tablet itself, especially concerning motivation, seem to dominate research on the usage of tablets in school. Another finding relates to children’s agency regarding writing on screen as an important aspect of the digital writing. The ability to act through text production and interact digitally seems to be an essential driving force for many students at school. Furthermore, the positives and negatives of enhanced student freedom at the microlevel by using tablets for writing are discussed in the literature, with the finding that students appreciate and use their freedom regarding tablets, whereas parents are more concerned about it (Burnett & Merchant, 2017).

The act of writing changes in digital environments (Åkerfeldt, 2014). It becomes a construction of text, as jumping back and forth as well as adding and deleting are done constantly, in contrast to the more linear writing process during handwriting. For children, the consequences of writing something are less troublesome on a tablet than with a pencil and an eraser; and the students’ writing becomes

more process oriented (Hultin & Westman, 2013). Research is also concerned about the learning effects of digital writing for young students. Swedish qualitative studies have found that the students write longer texts when writing with digital tools (Hultin & Westman, 2013), especially when using speech synthesis (Dahlström & Boström, 2017; Genlott & Grönlund, 2013). Writing on digital tools also provides texts of a wider range of literacy genres (Hultin & Westman, 2013; Mills & Exley, 2014) and texts with better structure, content, and language (Dahlström & Boström, 2017; Genlott & Grönlund, 2013). Such findings contrast with Norwegian research on students' use of tablets; they find that teachers perceive that the students are motivated and master writing (Berrum et al., 2017). However, this research concludes that despite increased reported motivation, no significant advantages or partial competences in any subject are detected, such as letter segmentation or the ability to combine letters into words (Berrum et al., 2017). These differing results may be linked to research stressing that the students' academic learning seems to be more closely related to teachers' different literacy practices and knowledge than to whether the students write with pen and paper or digital tools (Damber, 2013). At the instructional level, the writing to read-approach, combined with using digital tools including speech synthesis, seems to cause a shift in early literacy teaching from traditional letter-based literacy teaching to a text production approach (Hultin & Westman, 2013). The consequences of this shift have not yet been fully explored. In sum, earlier research mainly focuses on the effects of digital writing, what the digital writing process entails, and adult perceptions about students' attitudes towards tablets, especially in terms of motivation. There is a need to scrutinize the reported student motivation and to analyze the students' on screen writing more in depth (Kucirkova et al., 2019), especially in a writing-to read environment. Our research contributes to the literature by providing the point of view of the youngest students as well as exploring their digital writing practices, their digital literacy, and their self-determination in a digital environment.

4. Theoretical perspectives

To analyze what young students do when they write individually on tablets using speech synthesis, we draw on the notion that literacy is a social practice involving text (Barton, 2007; Gee, 2015). A sociocultural approach to literacy implies that all meaning is situated in practice, which indicates that what is done using text, is part of what defines the practices of the persons involved in these specific situations (Gee, 2015). We employ two terms to analyze the writing situations of the students using tablets in their writing: *writing event* and *writing practice* (Rish, 2015), directly derived from *literacy event* and *literacy practice* (Barton & Hamilton, 2000). A *writing event* is understood as any event in life where writing takes place, including people involved, talking around text, body language, and the context (Barton, 2007). By studying several writing events, *writing practices* can be derived, including attitudes, values, feelings and social relationships (Barton & Hamilton, 2000). Digital literacy is more than reading and writing on digital devices; it involves, leisure, education and work elements. We follow Martin's definition in that "Digital Literacy is the awareness, attitude and ability of individuals to appropriately use digital tools and facilities" (Martin, 2006, p. 155). Such approach to digital literacy in which awareness and attitude are enhanced can be combined with self-determination theory (Ryan & Deci, 2002), thus identifying which energizing actions are connected to digital writing.

Young writers often write spontaneously and as a part of play (Hall & Robinson, 2013; Hofslundengen et al., 2016). Thus, they develop metalinguistic awareness, which is important for acquiring the alphabetical principle. This natural interest for writing, together with the access and affordability of technology, implies that children can interact with touch screen devices already in the preschool age, enhancing emergent literacy skills (Daniels, 2017; Neumann & Neumann, 2017). However, this so-called native digital generation does not have intuitive digital literacy (Gee & Hayes, 2011) and is dependent on guidance to master the alphabetical principle (Selwyn, 2010). Thus, the literacy practices of young learners using tablets is driven both by the students' natural, play-like approach in a known digital environment as well as the demands from the school.

5. Methods

5.1. Sample and data material

This study focuses on classrooms that use tablets with speech synthesis as the main medium of instruction in early literacy education. The participating school was chosen because the municipality implemented tablets with speech synthesis early in education as part of their school development plan, and the second grade is the first grade in their school and municipality that have used tablets from the first grade. The school is located in a multicultural environment. Both the school's and the municipality's results on national reading tests over the past five years are roughly in line with the national average. Further information about the students in the observed classes, such as detailed reading and writing levels or linguistic, demographic and ethnic backgrounds, is not gathered in this

study, as it was not deemed relevant for the research questions. We observed all 36 students in two classrooms for two days, focusing on the students' writing:

- 18 six-year-olds (first grade); 5 girls and 13 boys
- 18 seven-year-olds (second grade); 10 girls and 8 boys

The demarcation of the data gathering was done according to the teachers' plans for a writing course, from the motivational phase, via writing, to the finishing phase. To capture the complexity of the writing events, we used multiple triangulation (Denzin, 2009), which included the following:

1. Methodological triangulation

- a observation
- b text analysis

2. Data triangulation

- a video recordings from head cameras
- b screen recordings from student tablets
- c the students' finished texts
- d video recordings from whole class camera (see Table 2 below)

The four data sources served different purposes in the study. The head cameras, with integrated microphones, were used to monitor the student's writing, actions, and interactions. Due to limitations in the amount of data that could be stored and analyzed along with technical limitations (number of cameras available), the head cameras were worn by three focus students in each class, comprising a mix of girls and boys at different stages of their writing development. The screen recordings, which included the auditory speech synthesis as well as a visual replication of the screen, captured the auditory and visual productions that the individual students exhibited during the task. The students' finished texts, both digital and printed, were gathered for further text analysis.

The whole class camera captured the whole class and the teacher's work during the individual writing, meeting a common challenge in video research: getting close enough to the details without losing context (Blikstad-Balas, 2017). In addition, the class lesson was videotaped for contextual information (34 min in the first-grade classroom and 102 min in the second-grade classroom). Table 1 describes the type and amount of data material in more detail. The teachers knew that we were interested in the students' writing on tablets with speech synthesis, and thus designed the following writing tasks without our involvement, as we wanted as authentic a situation as possible.

Table 1

Overview of the data material.

	Head cameras (student 1–6)	Screen recordings (all students)	Student texts (all students)	Whole class camera
First grade	Student 1: 95 min Student 2: 95 min Student 3: 95 min Student 4: 100 min	14 recordings: 95 min ¹ = 1330 min	13 digital texts (day 1) ² 18 printed texts (day 2)	Individual writing: 95 min
Second grade	Student 5: 100 min Student 6: 100 min	18 recordings: 100 min = 1800 min	18 printed texts	Individual writing: 100 min
Total	9 h 40 min	52 h 10 min	49 texts	3 h 15 min

¹ Due to technical problems, there are 14 recordings but 18 students.

² Due to technical problems, there are 13 texts but 18 students.

- First grade, day one: Write a text about the positioning of your self-made spider in relation to a milk-carton house. Take pictures of different spider positions, glue it into the writing app, and write sentences.
- First grade, day two: Choose a picture from a place in the classroom (the teacher had spread laminated cartoon-like pictures all over the classroom). Write about the picture. (Later, the text was printed and illustrated).
- Second grade, both days: Write a story about a snowman that is afraid of something, get assistance with the problem from three helpers, and it all goes well. (Later, the text was printed out, and glued into the left side of a book. The right side was used for a drawing, which made the text multimodal).

We use a broad definition of text (Cope & Kalantzis, 2012) and demarcate the writing events using the text as a fixing point (Barton & Lee, 2013, p. 26). Thus, we define the beginning of the event as the observable moment the student opens the writing application and ends when the student has finished the text with drawings or pictures. We argue that a broad definition of text that goes beyond the written word is important, as the students may use several modalities, such as emoticons, pictures, videos, sound, drawings, and symbols in their products (Cope & Kalantzis, 2012). Fig. 1 shows the same writing event through the different data sources: the class camera, the head camera, the screen recording, and the finished text.

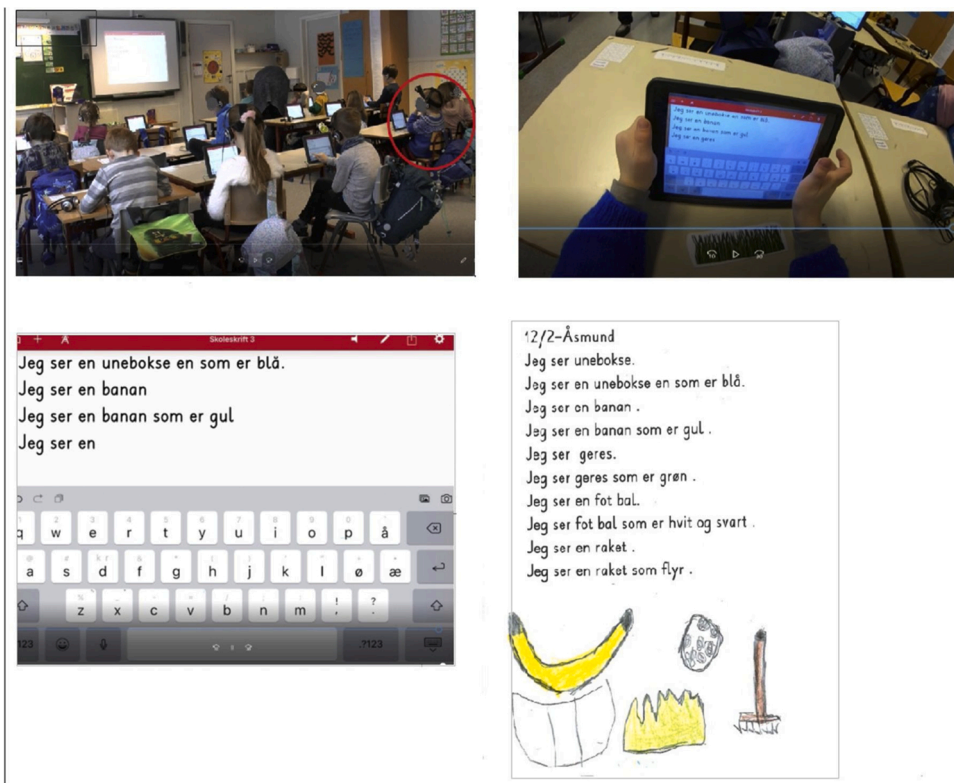


Fig. 1. One writing event observed through four different data sources.

5.2. Analysis

The analysis of the writing events (Rish, 2015) moved through different stages. First, we analyzed the overall context provided by the whole class camera, which included identifying activities through open coding and narrowing down to minutes (Fig. 2-5).

First grade



Fig. 2. Structure of writing event, first grade, day 1.

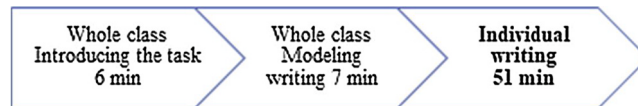


Fig. 3. Structure of writing event first grade, day 2.

Second grade

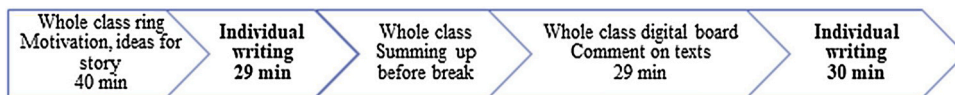


Fig. 4. Structure of writing event, second grade, day 1.

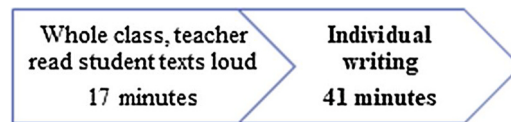


Fig. 5. Structure of writing event, second grade, day 2.

Second, the students' individual writing, marked in bold, was extracted for further analysis. We examined what the students were clearly occupied with during the writing event (Kucirkova et al., 2019). As the data primarily came from the head cameras, we saw what the students were looking at and heard their related conversations. Furthermore, the class camera could detect, for instance, if other students approached someone or leaned over to watch another tablet. The screen monitoring was used as a source to understand more specifically the writing, including detailed information about typing and deleting at the letter level as well as whether the speech synthesis was turned on or off by the student. In the third stage of the analytical process, we developed codes to closer analyze what young students are doing when they write individually on tablets with speech synthesis. As categories for analysis, we use the conceptualization of three basic psychological needs in human life according to self-determination theory: competence, autonomy, and relatedness (Deci et al., 1991; Ryan & Deci, 2002). According to Ryan and Deci (2002, p. 6), these needs provide "the basis for categorizing aspects of the environment as supportive versus antagonistic to integrated and vital human functioning." By addressing these human needs, we include contextual conditions that influence motivation, action, and development (Deci et al., 1991), central to understand the students' actions in the classroom. *Competence* is defined as "feeling effective in one's ongoing interactions with the social environment and express one's capacities" (Ryan & Deci, 2002, p. 7). In a school context, competence is, thus, not based on an attained skill but has to do with the student's own feeling of competence and success. *Autonomy* relates to self-initiation, meaning that we are the perceived source of our own behavior. Our actions are, thus, a result of interest and integrated values. *Relatedness* is about feeling connected to other individuals and a community and, in our case, to other students, the teacher, and the class. The need to be accepted by others is a basic human need (Ryan & Deci, 2002).

Table 2
Categories for analysis.

Main category	Description	Subcategory	Description
Competence	These are situations in which the students show or talk about their competence, for instance writing competence or digital competence.	Literacy competence	Students show competence within literacy, independent of the digital environment.
		Digital literacy competence	Students show digital competence, dependent on the digital environment.
Autonomy	These are situations in which the students make their own choices based on their interests and values within the classroom frame.	Literacy autonomy	Students show autonomy within literacy, by making choices others than the ones given by the teacher.
		Digital autonomy	Students show autonomy within the digital environment by making choices other than instructed by the teacher.
Relatedness	These are situations in which the students express that the relation with other students or the teacher is important.	Literacy relatedness	Relatedness emerges from an interest in literacy.
		Digital relatedness	Relatedness emerges from an interest in the digital environment.

5.3. Trustworthiness

Video data have some obvious advantages linked to transparency, as the videos can be viewed again by multiple researchers (Blikstad-Balas, 2017). In this study, both researchers were involved in and the discussions about categorization. The categories are based on an operationalization of well-established concepts from self-determination theory in conjunction with the data, focusing on construct validity (Kleven, 2008). The triangulation in the study provides a picture of what is going on in the classroom from multiple perspectives, thereby validating the findings of this qualitative research (Creswell & Miller, 2000). Exploring in-depth strategically chosen writing events as we do in this study has some consequences for transferability of the results. The results of this study cannot be claimed to apply for every comparable writing event in every classroom. Our goal is, however, to understand more of what these specific students do and get a deeper understanding through comparing our results with existing research. In this way, we aim to contribute to the knowledge base about writing in initial education.

5.4. Ethics

The study is carried out within the guidelines of the Norwegian Centre for Research Data, including gathering informed consent from the teachers and the parents in the two classes on behalf of the students. The students' names are anonymized.

6. Results

6.1. Writing in a classroom context

As shown in Figs. 1–4 in the methods section, the students in these writing sessions had ample time to write individually—95 min in the first grade and 100 min in the second grade. The classrooms were quiet, as the students wore headsets and were not encouraged to collaborate. The students wrote most of the time they were left to themselves, and they produced texts longer than expected for their age – from 12 to 111 words for first-grade students and 55–246 words for the second-grade students, resembling other research connected to writing on tablets (Genlott & Grönlund, 2013). Three examples, one from each task, are included to give an idea of the final student texts. Task 1 was to write sentences about the spider and take pictures (Fig. 6).

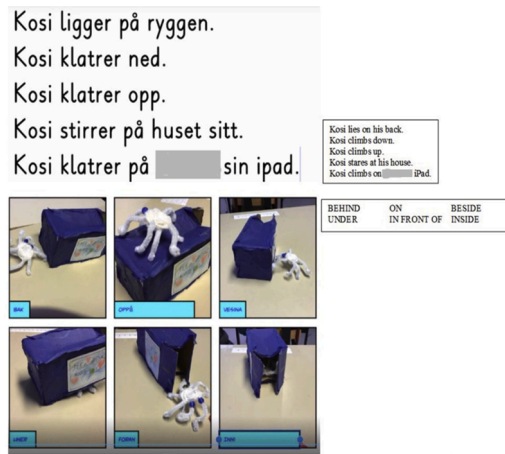


Fig. 6. Task 1. Student text first grade, day 2. Task 2 was to write sentences connected to the picture (Fig. 2).

Task 2 was to write sentences connected to the picture (Fig. 7).

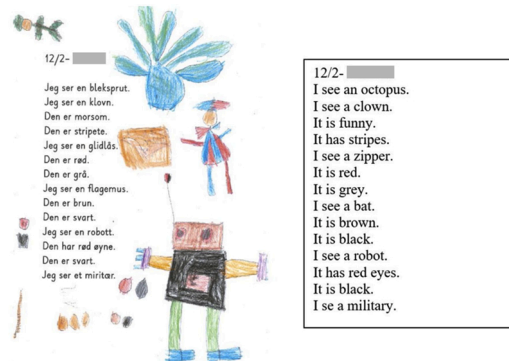


Fig. 7. Task 2. Student text first grade, day 2. Task 3, in second grade, the students wrote a story about a snowman (Fig. 8).

Task 3, in second grade, the students wrote a story about a snowman (Fig. 8).

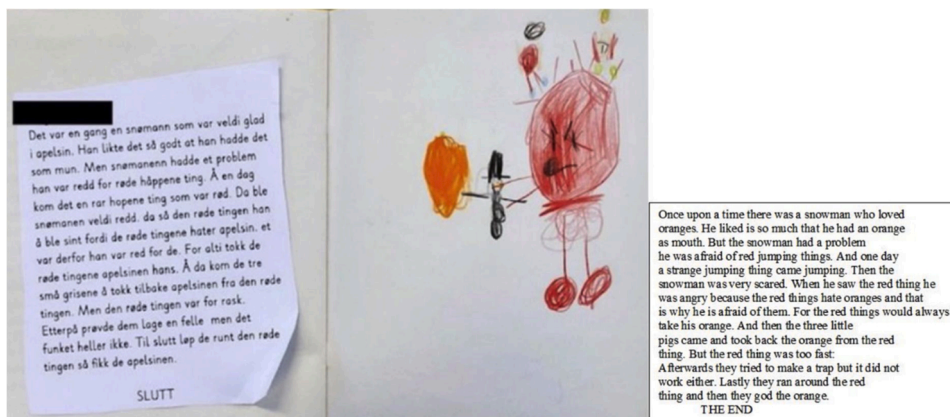


Fig. 8. Task 3. Student text second grade.

During the writing task, the students' time was dominated by composing their texts. They worked individually and silently over long periods of time (from 30 to 51 min.). Our main impression as observers was that the students seemed concentrated on writing. Their compositions were multimodal, combining verbal text with digital pictures or drawings, in alignment with the teachers' instructions. Also, as determined by the teachers, the students in first grade wrote single sentences, while the students in second grade wrote a story and more coherent texts. While on the surface, the task involved writing, an in-depth analysis showed that other phenomena were also occurring. To get closer to the writing event (Rish, 2015) from the students' point of view, we have therefore selected examples to provide insight into what seemed to motivate the students' actions during the writing events. The examples demonstrate the social view on literacy described earlier and consist of students' texts at different stages in the writing process, but also transcripts of the students' communication with each other about writing and texts, including mostly talk, but also body language (Barton, 2007). The chosen examples are sorted according to the categories presented in the methods section from self-determination theory: competence, autonomy, and relatedness.

6.2. Competence

As we study writing as a part of a social context, we see competence as situations in which the students show or talk about their competence to others. The following section is divided into literacy competence and digital literacy as competence, with the most extensive findings related to the latter category.

6.2.1. Literacy competence

In both grades, students scrolled up and down to get an idea of how much they had written and to remember what they had written. They often compared with other students how much they had written. Of the relatively few conversations observed, conversations about length dominated.

Jenny scrolls down the screen. Jenny: I only got fifteen sentences. Simon: I got many, many, many, many, many. Celina: Look how many I got. (*Scrolls down the screen.*)

(First grade)

Oliver: Look how much I wrote. I have written this much. (*Shows the tablet in portrait format.*) Thomas: Yes, so what? I have written much more than that. Once I wrote seven sheets.

(Second grade)

As we see, writing long texts is a competence that the students take pride in showing to each other, and it seems to be the main marker of writing quality for the students. The desire to write long texts included a touch of competition and held an important motivating power in the students' writing.

6.2.2. Digital literacy competence

The app the students use affords not only the possibility to write words during the writing event but also to listen to the speech synthesis, evaluate whether the pronunciation resembles the intended word, and either try a new version of the word or, being satisfied, move on to the next word. Many of the students in the first grade had learned that the Norwegian language often uses double consonant after short vowels, but some of them tended to overgeneralize this phenomenon, which probably represents a stage in their writing development. One example was Jacob. He had a picture of a yellow (*gul* in Norwegian) duck, and he writes: "I see a duck. It is." He was probably going to write that the duck is yellow (= *gul* /g:l/), but he wrote *gull* (/g (meaning *gold*)). The voice in the speech synthesis read *gull* with a short vowel, and Jacob removed an *l* (= *gul*). He then kept on writing. Jacob also tended to mirror some of the letters. When he was going to write *edderkopp* ("spider" in English), he wrote "Ebber." Then he exclaimed irritably, "Ahh!" and changed the text to *edder(kopp)*. Jacob thus corrected himself, based on the speech synthesis. Also, for the second-grade students, the short vowel was a source of frustration. Emma tried to write "it didn't work" (*gikk ikke* /ji:k ik:e/), with double *k* but instead wrote "gik ike" (/ji:k i:ke/). She heard it read incorrectly, said the correct way over and over, but was incapable of changing it. "I can't do it!" she exclaimed. The students also used the speech synthesis for experimentation, as in these two examples from first-grade students David and Anna (Figs. 9 and 10):

The students used different strategies when the redline did not disappear. In the next examples, the application caused students to start communicating with one another. A student looks at a neighbor's tablet and comment on orthography:

Jenny gets a red line under "rejnbug" (=rainbow). She tries "ræjnbug," but the red line is still there.

Alma: Why are you writing wrong?

Jenny: Do you know how to spell it?

Alma: That's not how to spell it. Words with red dots, that means they are wrong. Jenny: Yes, but there are many wrong words.

Alma: I don't have any wrong. Look!

Jenny: Maybe you got a little help? But I wrote much more than you did. (Scrolls down the screen.)

(First grade)

Samuel: You haven't written anything. Oh, there is something.

Helena: Yes, I have.

Samuel: Alright. How do you write it? What happened to the traffic light? Traffic light is one word [in Norwegian]. I'm just saying. Everything else is correct. I don't want you to be sad.

(Helena removes the space between "traffic" and "light".)

(Second grade)

To sum up, the main activity in the writing events that started individual action and, thereby, displayed digital literacy competence was writing long texts, followed closely by writing words correctly. Incorrect words were identified either by the speech synthesis not resembling the word in the student's mind or by the spelling check through a redline. The students mainly dealt with these challenges alone, tried variations of spellings and did tricks, but in some cases the orthography competence combined with digital competence was, as we have seen, also used as show off to others.

6.3. Autonomy

During writing events, students made their own choices based on their interests and values, which is called autonomy in this study. The students showed both literacy autonomy and digital autonomy, as described in the following sections.

6.3.1. Literacy autonomy

Literacy autonomy is connected to writing in this case, independent of the digital environment. An example of this was when Helena made chapters in her text, which made Samuel, who was constantly leaning over Helena's tablet, to ask about what she was doing.

Samuel: Helena, are you starting on a whole new story? What is the second pig supposed to do? Do you want me to tell you what my snowman is afraid of?

Helena: Ok. Samuel: Can I have a look? Helena: Then we must go to chapter one first. Samuel (*reading Helena's text*): The traffic light, and then you made a new [sheet] and called it chapter two?

Helena: Yes, so what?

(Second grade)

Making a chapter was not within the task, not done by any of the other students, and clearly an autonomous decision made by Helena. She experimented with a hallmark of longer texts, which were written as books. Besides this example, there were few examples in this category, as the content or text levels were prone to little discussion or even attention. This is the reason why content is given limited attention in this article.

Students also used digital tools to write profanities, which the teacher was not supposed to see, as David did in the next example (Fig. 12).



Fig. 12. Example of literacy autonomy. David writes something illegal, deleting it shortly afterwards, without anyone noticing.

David was probably tired of writing about the spider, so he wrote “Oh, I don’t know. Fuck.” He showed the girl besides him what he had written but deleted it before the teacher came to his desk, which may demonstrate writing as an expression of attitudes and feelings within a social context (Barton & Hamilton, 2000).

6.3.2. Digital autonomy

Digital autonomy is connected to the digital environment, both the tablet itself and the designated application with speech synthesis. During the writing, some students used other semiotic systems than letters to express what their spider was doing, for instance emojis:



Fig. 13. Example of digital autonomy, Elliot’s use of emojis (1).

Elliot used emojis to tell that the spider had made a web (Fig. 13). In the next example, Elliot showed morphological competence when using the spider emoji + “en” (Fig. 14):

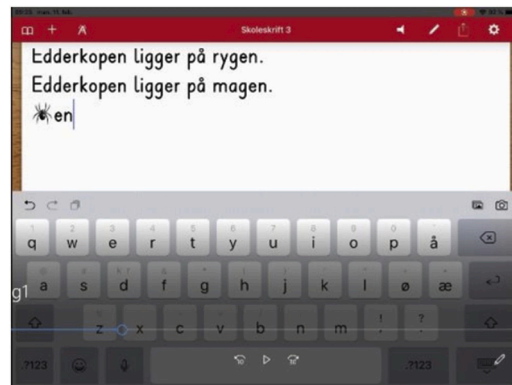


Fig. 14. Example of digital autonomy, Elliot’s use of emojis with morphological awareness (2).

In Norwegian, a suffix signals a definite form of a noun, in masculine, “en”. Thus, when Elliot was going to write “edderkopen” (the spider), he used the spider emoji + en.

The students constantly get immediate feedback on their writing through the speech synthesis. For some students in this study, the speech synthesis was a disturbing element, and they, therefore, developed strategies to avoid hearing the speech synthesis, as in the following example of Philip:

Teacher: The third time the fairy tried to... Philip: set

Teacher: set (*makes an exaggerated short vowel*)

Philip: Two t’s?

Teacher: Yes. It’s great that you hear these bouncing sounds (*short vowel*). “And it went...” How did it go? Tell what happens. (*The teacher leaves.*)

Philip: It went... (*Removes the headset and continues to write.*) It went very, very, very well. (*He reads the text as he writes, the words with short vowels are spelled incorrectly.*)

(Second grade)

Philip received guidance from the teacher, who mainly focused on his orthography. In the end, the teacher asked about the content, the only example we have of this, posing the question: “How did it go?” Philip seemed engaged in the story and the content, as he responded, “It went very, very, very well.” He started to write but then took off his headset. Perhaps he did so because he wished to avoid the reading of his text, preferring instead to concentrate on the content of his story. In sum, autonomy within the writing events seemed to be connected to two main impulses. First, we observed experimentation with the semiotic resources included in the application. The teacher did not encourage the use of emojis, but they seem to be a well-known resource for many students. The use of emojis provided new possibilities in the students’ creation of words and texts in comparison to more traditional student writing in the first years of schooling. Here, the students found possibilities, based in the digital environment, to entertain themselves or their peers. This kind of writing was not necessarily outside the task, but it was outside the teacher’s instruction. Second, the pragmatic use of the digital tools through, for instance, avoiding speech synthesis illustrated another form of autonomy. This was probably an attempt to focus on the content of the story, rather than the spelling. The student found his own solution without the teacher knowing. This can be seen as a part of the students’ digital literacy and ability to appropriate use of digital tools (Martin, 2006).

6.4. Relatedness

Relatedness occurs when students interact with other students or the teacher and is a cornerstone within a social view of literacy (Barton, 2007). Paradoxically, considering this category, the students mainly worked alone on their tablets. However, some interaction did occur, as the teachers did not forbid the practice. The writing did, however, seem a bit private, and there were many examples of students hiding their screens from each other. Students indicated the secrecy of their texts stated through words, or through body language:

Lisa: You mustn’t look at mine!
 Celina continues watching Lisa’s screen.
 Lisa: You mustn’t look at mine, Celina!
 (First grade)

6.4.1. Literacy relatedness

Literacy relatedness occurs when students interact through literacy events, for instance by showing their text to another student. A girl in the second grade, Helena, was seated next to Samuel, who was writing a complicated and long text. She then showed him something she had made: a line full of symbols, as parentheses. Earlier, in the whole class setting, Samuel discussed the use of parenthesis with the teacher, which was clearly over the head of most of the class.

Helena writes ‘(((((((O)))))))*
 Helena: Look!
 Samuel: Are you crazy?
 Helena: Look!
 Samuel: You can’t be that crazy.
 Helena: I was just bored. (Erases the symbols.)
 Samuel: Have a look at my book. It is called “The Farting Book.”
 (Second grade)

Through this interaction, Helena displayed her literacy by creating parentheses, symbols which seemed new to her. This allowed her to do something crazy and to impress Samuel. He then showed Helena a book he was reading, about farting, a crazy thing to read about, which strengthened their bond (Figs. 15 and 16).

6.4.2. Digital relatedness

Digital relatedness occurs when the digital environment is used to relate to others. A student named Peter contacted Thomas. The story about his snowman was finished, and Peter wrote, “The end” (“slutt” in Norwegian). He wanted to show something he had just discovered at the end of his writing session. From the head camera on Thomas, we got the following recording:

Do you want to hear it? It is really a nice sound. (Peter puts his hands to his headset, starting to lift it off, but suddenly turns around and focuses on his tablet. He plays the speech synthesis on the last sentence repeatedly.)
 (Second grade)

Peter’s screenshot reveals that he wrote the word “slutt” 18 times. The symbol for speech synthesis, the megaphone, was dimmed because the words were read aloud. The boy repeated this five times. He listened to the rhythm of the words, danced with his head, clearly enjoying the new dimension of the writing event. The question “Do you want to hear it” followed by a gesture of lifting the headset, points in a direction of inviting Thomas to join, a relatedness between the two boys. However, Peter abruptly cutting the connection between them by turning his back to Thomas, looking on his tablet.



Fig. 15. Example of relatedness. Caption of screen monitoring. The dim sound symbol indicates that the speech synthesis is on, reading "SLUTT" repeatedly.

This situation gives an example of a student discovering new things about the device—for example, the speech synthesis repeating a word with an even pace, creating a rhythm for the boy. Altogether, 14 min were used after the text was over. The boy displayed some of the possibilities the tablet offers, and he demonstrated how to use them within the limits of the classroom and class rules, thus also displaying digital literacy (Martin, 2006). However, we chose to present the whole situation as relatedness, as lastly, he shared his new discovery, displaying digital relatedness, and appreciated the moment of entertainment in a challenging environment.

The students also cooperate regarding technical solutions or tricks, as the following example illustrates:

Hanna asks her neighboring student how he was able to change the colors of the page background. He shows her.

Hanna: That was easy.

She giggles and sings, changing backgrounds and colors.

(First grade)

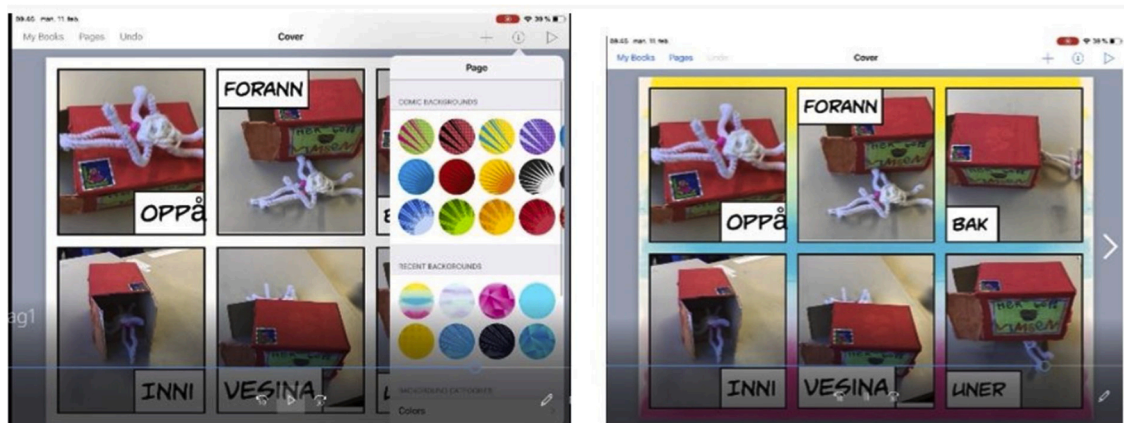


Fig. 16. Example of digital relatedness. Hanna is showing another girl how to change the background.

To sum up, in terms of how self-determination is connected to relatedness in the material, the results reveal that showing each other new discoveries, non digital or digital, is a way of interacting with peers during a writing event. The writing events are thus a part of a social practice, despite that the classrooms are dominated by individual writing. Also, making something entertaining, as hearing a word on repeat in the speech synthesis, is worth showing to others. These examples also showed that the categories used in this study are not mutually exclusive. Several of the examples where the students relate to each other during the writing event, contain social positioning through showing competence to each other. This positioning may, as we have seen, also include an autonomy aspect since it seems to happen without the teacher being aware of it.

7. Discussion

This study explored the writing events of 36 students in the first and second grade at the micro level through a class camera, head cameras, screen recordings, and student texts. Our research questions were as follows:

- 1 What are students doing when they interact individually with tablets with speech synthesis in early literacy education?
- 2 What seems to motivate the students' actions during the writing events?

Our findings show that the classrooms were silent, taking the age and the long periods of individual work into account. This was probably due to the use of headsets, emphasis on individual work, and no encouragement of collaboration. Furthermore, the students were apparently occupied in writing, not acting out or doing other things off task. From a teacher's point of view, this may look like a sign of motivation and engagement for writing on tablets, as several studies have reported (Couse & Chen, 2010; Flewitt et al., 2015; Hatherly & Chapman, 2013).

Regarding what the students were doing, there are two aspects directly connected to the writing assignment. First, most of the students wrote long texts, corresponding with other research (Dahlström & Boström, 2017; Genlott & Grönlund, 2013; Hultin & Westman, 2013). The students were also concerned and competed with the length of their texts. This is important for the students' idea of literacy competence as well as a way for them to interact and relate to their environment (Gee, 2015; Martin, 2006). Writing texts of a certain length seems to be a part of the students' way of confirming their competence in writing. The competitive element appears as a driving force and a part of students' motivation for writing. Second, there was a large focus on orthography, even though the national curriculum at this level does not mention it or set standards related to orthography for the students. This emphasis was probably due to the application that synthesized speech.

The speech synthesis can inspire correct spelling to a greater degree than may be common in writing events with young children. Hence, the somewhat narrow academic competence of orthography may overshadow other aspects of writing, such as vocabulary, content, structure, and exploratory writing. Our study, at the micro level and from the student point of view, shows, however, a span of actions much broader than what would be considered writing. Quite frequently, the students did other things than write the assigned text, seemingly either to entertain themselves or to interact with others. This is similar to findings of students in high school, where the students were occupied with other than academic work on their laptops during lessons (Blikstad-Balas, 2012). We see this as part of the students' choices (Koh, 2020) and their motivation; their self-determination was realized through both autonomy and relatedness (Ryan & Deci, 2002). Two aspects can summarize what the students do when they are not directly writing within the writing event. First, the students entertained themselves by testing what the application has to offer. For example, the speech synthesis was used as a rhythm producer by one boy, inspiring dancing movements. Second, the students sought interaction with peers by showing interesting things they could do with their tablets, seen as relatedness (Ryan & Deci, 2002), as interacting with the application alone was not sufficient. It is interesting that they show off with their digital competence, seldom within writing. These multifaceted actions are all part of the students' writing practices (Kucirkova et al., 2019; Rish, 2015), and their digital literacy (Gee & Hayes, 2011; Martin, 2006). Our interpretation is that these actions may be a prerequisite for the young students to be able to stay focused and sit still for long periods. Their motivation, as defined through the self-determination theory, included both the ability to stay on track—namely, following the teacher's instructions—work autonomously and interact with other students (Ryan & Deci, 2002). Furthermore, the students got back on track with their writing assignment by themselves, with no incentives from the teacher.

The digital literacy practices (Barton & Hamilton, 2009) of the young students were influenced by two forces at the micro level. On the one hand, the digital form of writing enabled easier production of letters, which made for faster writing. On the other hand, the speech synthesis demanded that the students slow down and listen to what they had written in order to decide whether each word was correct or not, which activated their metalinguistic awareness. Thus, the students, given their limited cognitive resources, were placed in a dilemma: should they focus on the content and flow of their text, or should they write as correctly as possible? In this dilemma, the content seemed to come second, as there were few examples where the content appeared to be at the center of the students' writing. This may be due to several factors. First, students in the first and second grades use a lot of energy in the process of encoding. Second, the technology's endless possibilities can steal attention from the content, as engaging with the technology can seem more motivating (Ching, 2018). Third, strict framing of the texts by the teachers in terms of both content and text structure left little room for student creativity regarding content. Without generalizing to larger conditions, we can conclude that the writing practices among the 36 students were dominated by individual writing with an emphasis on measurable elements (i.e., text length and orthography), entertaining elements within the digital environment on the individual level, and social interactions (i.e., competing on length and hiding actions such as writing and deleting illegal text).

7.1. Limitations

Despite the strengths of our study, there were some limitations that we would like to acknowledge. The participant groups were limited and we observed the classrooms for only two days each. This microlevel approach combined with the data triangulation provided still detailed information about digital writing from the students' point of view and made it possible to answer the research questions of this study. Thus, our research contributes with important findings to the literature base on writing using tablets with speech synthesis in the first years of schooling.

8. Recommendations for practice, policy and future research

Our study shows that the use of 1:1 tablets with speech synthesis can limit the literacy practices for the young students in the literacy education to a narrow focus on text length and orthography. Furthermore, individuals' writing with headsets does not encourage collaboration, which is in contrast to the way children usually learn (Hall & Robinson, 2013; Love & Sandiford, 2016). In order to meet the young students' needs for a variety of literacy experiences as well as interactions with peers, the teacher must be aware of these challenges. Moreover, an acceptance of the students' engagement and motivation for using the tablet can make it possible for them to stay focused in the writing event. Their autonomy makes them stay on track for most of the time.

The lack of focus on content in the students' digital writing is an interesting topic for further research, both for the youngest students and for older ones. Is it a common challenge that content loses ground in digital writing, and it is important to explore what teachers can do to emphasize the content aspect in tablet-based writing that uses speech synthesis and in other digitally-based writing forms. Policy documents could preferably enhance a variation in the early literacy education, to avoid a dominating focus on orthography and individual writing but also the importance of content, text grammar, creativity in designing multimodal texts, peer feedback and collaborative writing. Another related topic for future research is to investigate whether headphones are a necessity or a barrier for digital writing on tablets in the classroom, taking age into account.

9. Conclusion

A common experience among teachers in classrooms with 1:1 tablets is that the students are motivated. In this study, we show that young students writing 1:1 on tablets with speech synthesis are, apparently, writing for long periods. Video recordings, screen recordings and student texts show that the students are especially concerned about text length and, due to the speech synthesis, orthography, while content gets less attention. These demanding sessions, with long periods of individual writing, make the students resort to other activities, using their autonomy for leisure or relatedness. Interestingly, the students camouflage their actions, so the teacher would assume they are still writing, a sign that can be interpreted as motivation from the teachers' point of view. Furthermore, the students seem to get back on track after the distractions, without the teacher telling them to. To accept these actions within the writing event may be a way to understand the writing practices for the young students and what lies within the much-reported motivation for digital devices in school.

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