



Shared, dialogue-based reading with books vs tablets in early childhood education and care: Protocol for a mixed-methods intervention study



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ABSTRACT

This paper presents the study protocol for a research project assessing the appropriateness of picture book apps in shared reading with young children. An intervention study was carried out in six ECEC institutions, comparing teachers' (N = 12) and children's (N = 72; M = 57.2 months) engagement during reading with print books and apps. The study has a mixed methods design, supplementing video data with questionnaires, focus group interviews, and reflection logs. Aiming for an ecologically valid setting, the reading is carried out with groups of children. Outcome measures include verbal and nonverbal engagement during reading. Results are relevant to teachers, teacher education, policy makers, and researchers interested in the impact of digital technologies on reading with young children.

1. Introduction

1.1. Background and policy context

Early childhood education and care (ECEC) institutions play an important role in the lives of many children, in providing activities tailored to nurture and support children's cognitive and socioemotional development. However, there is considerable variation with respect to the content and quality of pedagogical practices in such institutions. This article presents the protocol for a study carried out in a Norwegian ECEC context. Regular center based ECEC is defined as preschool or kindergarten for children between 3 and 6 years of age (OECD, 2017, p. 59). In Norway the term 'kindergarten' was formalized as a common service for children by the first Kindergarten Act in 1975 (Kunnskapsdepartementet, 2012). In the present study, the term 'kindergarten' is applied when referring to ECEC institutions.

In Norway, kindergarten practices and activities are governed by The Kindergarten Act and The Norwegian Framework Plan (FP) for kindergartens' content and tasks (MER, 2017). In the Norwegian FP, play, care and learning are seen in context of each other, and ensuring participation in the community of the institution is an important value. In order for all children to participate, it is common in Norwegian kindergartens to organize structured activities in *groups*. A central pedagogical activity such as shared reading, for instance, can be carried out with all children in one kindergarten section (often up to ten, depending on kindergarten size), or with smaller groups, and sometimes one to one (Hoel et al., 2011). Due to staffing standards of Norwegian kindergartens, shared readings in the present project are carried out in groups of up to six children.

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With more than 90% of children (age 1–5 years) attending kindergartens in Norway,¹ it is vital that kindergarten teachers can engage the children in high-quality pedagogical activities (e.g., Sylva et al., 2007). The FP defines the kindergarten as an arena in which children engage in creative processes and activities, together with the teachers, using a wide range of tools, media and materialities for creative expressions, meaning making, and communication. Of particular relevance for the present project is the focus on new media typically found in the everyday lives of children today, such as digital technologies. An important task for teachers is to help children develop an understanding and critical awareness of the role of media in today's society (MER, p. 47f). In recent years, tablets such as the iPad have become particularly popular to use with young children, due to the intuitive touch screen interface, which is considered more user friendly than a PC or laptop (Couse & Chen, 2010; Kucirkova, 2017; Merchant, 2015; Romeo, Edwards, McNamara, Walker, & Ziguras, 2003). The popularity of the tablet has led to a surge of digital stories developed for young children, especially in the world languages (Bus et al., 2019).

Reflecting an international trend pointing to the largely untapped potential of digital technologies to support children's creativity and agency in ECEC contexts (e.g., Snow et al., 2017; Stephen & Edwards, 2018), there is a need for better guidance for teachers in using digital devices in pedagogical activities (Jacobsen, Kofoed, & Loi, 2016). The present research project – VEBB² – is developed to provide research-based guidance with respect to one particular pedagogical activity – that of *shared, dialogue-based reading* (henceforth, SDBR) with groups of children, using picture book apps and touch screen tablets. SDBR is a research-based method (see, e.g., Mol, Bus, de Jong, & Smeets, 2008) encouraging children to engage in cognitively enriching dialogues that go beyond the here-and-now (see elaborated definition below).

Tablet technologies provide new platforms for the presentation of stories for children. We use the term *picture book app* to refer to digital multimedia stories combining text, animations, sound and interactivity, and that are read on a tablet. There is a growing number of studies exploring the role of the medium on shared reading with children, but these typically study reading in *pairs* – one teacher/parent and one child (see, e.g., Dore et al., 2018; Parish-Morris, Mahajan, Hirsh-Pasek, Golinkoff, & Collins, 2013; Yuill & Martin, 2016). In order to reflect a reading situation which is more common for a kindergarten context, we designed the reading setting in *groups* of up to six children. Though still smaller than a typical reading group in most kindergartens, it is closer to what is representative for teachers' reading with children in Norwegian kindergartens.

1.2. Theoretical rationale

Young children develop their language competence primarily through the active use of language in a diversity of settings and contexts, engaging in rich – i.e., cognitively stimulating – dialogues with adults and peers as scaffolds (Bruner, 1990; Burger, 2015). An activity known to optimally facilitate such rich dialogues, at home and in early childhood educational settings, is *shared, dialogue-based reading* (SDBR) (Mol et al., 2008).

In SDBR, the teacher takes on the role of a mediator of the story, to the children. The teacher is in charge of encouraging the children to engage actively in the dialogue (Mjør, 2009). This way, children engage in *extended discourses* (Dickinson & Tabors, 2001), which are particularly supportive of their language development. The teacher's role is to initiate and maintain such dialogues (Burger, 2015), pausing to elaborate on a story, using exploratory questions related to the text (Gjems, 2007), questions that extend beyond the immediate context (Smith & Dickinson, 1994), follow-ups, and clarification cues. The dialogue is also supported and maintained by the semiotic resources of the book – e.g., the pictures and the iconotext³ (Alfheim & Fodstad, 2014; Hoel et al., 2011) – as well as the children themselves. A child may, for instance, notice a detail in the illustration, form associations, or wonder about an unusual or new word. In such cases, it is vital that the teacher is responsive to the child's discoveries and questions, actively using them to maintain and carry the dialogue further.

Traditionally, reading in kindergarten has been performed with print picture books. The popularity of tablet technologies has led to a surge of *picture book apps* for young children (Bus et al., 2019). Picture book apps vary considerably with respect to technological as well as modal affordances: some add animations and soundtrack to its print counterpart and keep the story intact, whereas others depart from the narrative in the print book to create a more game-like experience (Bus, Takacs, & Kegel, 2015). Hence, intriguing research questions emerge concerning the role of reading technology or medium, and medium-specific affordances, in shared reading in general, and in SDBR in particular. The present study is designed to address this issue, in close collaboration with kindergartens and teachers. Data from video observations, questionnaires, and teachers' didactic reflections in the form of session logs provide the empirical basis for developing key parameters for an online evaluation tool assessing to what extent and in what ways given picture book apps are appropriate for use in shared, dialogue-based reading with young children. This tool will help teachers and caregivers to make pedagogically sound, and research based, decisions when using picture book apps in shared, dialogue-based reading with young children.

The interactivity of a digital text on a touch screen tablet invites clicking and manipulating the content on the screen. Such activity may interact in more or less supportive ways with the dialogue surrounding the story, and studies have shown that it may detract children (and adults) from the content and towards the mechanics of the medium (for overviews, see e.g. Barzillai, Thomson, & Mangen, 2018; Reich, Yau, & Warschauer, 2016; for a meta-analysis, see Takacs, Swart, & Bus, 2015). For instance, Parish-Morris et al. (2013) compared parent-child (3 year olds) dyads reading stories in print or on electronic console books. They found that

¹ <https://www.ssb.no/barnehager> - accessed 06.06.2018

² VEBB is an acronym for "Vurdering av E-Bøker for Barn" (Evaluation of E-Books for Children).

³ The interaction between two semiotic systems, verbal text and image, in a picture book (Hallberg, 1982).

parents in the print book condition made more content related utterances, such as asking children to relate the story to their own lives, whereas parents in the electronic group displayed significantly more behavior-related utterances, such as asking the children to interact with specific elements of the screen – e.g., “Touch the puppy and it will play a song!”, or asking to turn the page.

In another study, Yuill and Martin (2016) compared the reading of a picture book with one read on an iPad, assessing, among other things, physical interaction – what they call “interactional warmth” – while reading on the two devices. Finding that interaction warmth was lower for tablet reading than for book reading, the authors conclude that the physical differences between the book and the iPad “can be expected to influence the embodied experience of shared reading.” (2016, p. 11). The ergonomic affordances and sensorimotor contingencies affect the proximity as well as the nature of the interaction, making the two reading situations best described as “curling up with paper [and] shoulder-surfing with screen” (2016, p. 8). The role of such differences is readily recognized in the increasingly influential research paradigm of embodied cognition. Inspired by such findings and aiming to shed further light on associations between embodiment and cognition – comprehensively accounted for in various facets of the embodied cognition paradigm (see, e.g., Newen et al., 2018; Shapiro, 2010; Wilson, 2002) – VEBB explores the role of medium materiality and how children’s and teachers’ haptic exploration of technological interfaces interacts with dialogue during reading.

2. Study aims and research questions

VEBB supplements and goes beyond extant research on print and tablet reading with young children, in several ways. Firstly, having the teachers read with groups of (up to six) children provides a more ecologically valid setting than is common in the research literature. Reading activities in Norwegian kindergartens are typically group activities (often involving up to ten children), and SDBR provides a *social context for reading* in which peer-to-peer interactions amongst the children are as essential as the interactions between children and teacher. In order to better understand the role of medium affordances on children’s verbal and non-verbal engagement during such reading sessions, these vital social aspects of the reading context need to be taken into consideration in the design.

Secondly, VEBB extends current research on reading with print and digital materials by an in-depth exploration of associations between verbal and non-verbal engagement – in particular, pointing and clicking. Of particular interest in the current project is the ways in which haptic engagement with the reading device – touching the book, pointing, clicking and swiping on the iPad screen – influences the dialogue around the story during reading. The codebook is developed in order to enable a more fine-grained categorization of the amount of haptic engagement during dialogues, while at the same time taking into account both *quantitative* (i.e., duration and frequency) and *qualitative* (i.e., types of discourse) aspects of the dialogue.

Thirdly, a mixed methods approach allows a deeper as well as a more comprehensive analysis (e.g. Johnson, Onwuegbuzie, & Turner, 2007) of interactions between the children and the adults, and amongst the children themselves. Both frequencies and durations of particular actions and events, either individual or relational to other people or to the medium, as well as the content of actions/events and, perhaps most importantly, the dialogues can yield relevant knowledge in support of the objectives of the present study.

The *research questions* driving the development of the VEBB evaluation tool, are as follows:

RQ1: How do medium affordances affect the dialogue between the teacher and the children in shared, dialogue-based reading (SDBR)?

RQ2: Which parameters pertaining to story and medium are important when assessing the appropriateness of picture book apps for shared, dialogue-based reading?

3. Study design

VEBB is a multi-method study combining questionnaires, didactic reflection logs and semi-structured interviews with video data of reading sessions carried out with groups of three to six children⁴ by twelve teachers in six participating kindergartens.

In order to answer the research questions in a more ecologically valid way, it seems necessary to combine qualitative and quantitative data to explore affordances of the medium as well as the circumstances for – and the process of – shared, dialogue-based reading. Therefore, the study is based on a mixed method approach (Johnson et al., 2007) combining video data of reading sessions, questionnaires to parents and teachers, a questionnaire to the children immediately after the reading sessions, teachers’ didactic reflection logs, and semi-structured interviews with the teachers.

The frequency and duration of particular events and actions (mainly quantitative data) can be related to the medium and the way in which the reading process is organized by the teacher (qualitative analysis of the books before intervention and the teacher actions in the reading sessions). How often and for how long different types of behaviors and dialogues between teacher and child (and between children) occur, gives an indication of the impact of the medium and the teacher (and the interaction between medium and teacher). However, in order to understand the pedagogical potential of the medium and the teachers’ and children’s behavior, content analysis of individual and social processes is crucial. The content and quality of dialogues, both between teachers and children and among children respectively, is the key empirical foundation for understanding and explaining the children’s and teachers’ actions. Furthermore, background information such as the children’s home learning environment and demographic data, their interest in

⁴ To allow comparisons across reading sessions, the groups were kept intact; hence, in the case of absences (due to e.g. illness), some readings are performed with as few as three children.

reading based on their responses after reading sessions and the teachers' professional experiences, reflections and attitudes (all of which qualitative data based on questionnaires and (group-) interviews) are all vital for a better understanding and interpretation of the video based observations.

To sum up, the study combines qualitative and quantitative data in a mixed methods design:

- video observation (intervention)
- questionnaires
- background information from teachers and parents: demographics, reading habits, experiences with and expectations about digital technologies in reading
- children's responses after reading sessions (measured by a questionnaire using smileys, administered by the teacher)
- teachers' reflection logs after each reading session
- focus group interviews with teachers after the intervention

The intervention is carried out in six kindergartens, in which twelve teachers each read two books with a group of children ($N = 72$). Both books are read in both reading media – i.e., print picture book, and picture book app read on an iPad. The video material thus comprises 48 films with a total duration of 18 h 47 min ($M = 23$ min 29 s, $SD = 9$ min 42 s; min. 5 min 18 s, max. 55 min 52 s).

In line with Johnson et al. (2007) we define our mixed method approach as a convergent (concurrent) design where qualitative and quantitative data are collected and analyzed in one timeframe, when it comes to the core empirical data, the video based observational data. In terms of background information (e.g. parental and teacher questionnaires), therefore, the design may be denoted as case study framework where qualitative and quantitative data are collected to build a comprehensive understanding of a case (Johnson et al., 2007). As such, the mixed method approach in VEBB can be seen as both sequential and concurrent. In terms of Creswell and Clark (2017), the current approach to linking different methods of data collection can be characterized as “embedding”, meaning data collection and analysis at multiple points. This approach then combines three more basic forms of linking data (connecting, building and merging), and is mainly applied in intervention studies where qualitative and quantitative data are recurrently linked.

3.1. Intervention: materials

Preparing for the video recorded reading sessions, the teachers had access to twelve picture book apps (most of them also available in book format). These backlist apps provided exposure to a rich variety of picture book apps for the children and teachers, and were intended to help teachers establish a digital reading practice. In parallel, a “front list” of four titles to be used in the video observation sessions was developed. All apps (on back- and front-list) were selected on the basis of four categories sorted from most book-like to more independent productions. This process was guided by categories established in previous studies (Tønnessen, 2014): 1) visual audiobooks, where the app merely adds a performed reading of the written text; 2) picture books with additional effects whereby the reader is invited to activate sound effects, animations or other visual effects; 3) picture book apps offering a higher degree of gamification while inviting – and sometimes demanding – the reader to engage interactively via digital technologies; and finally 4) digital first productions – also called “digital natives” (Schwebs, 2014). These categories were primarily designed to ensure variation in the selection of texts.

The following four titles were selected for use in the video-observation study:

- 1)
 - 1) Tove Jansson (2017) (orig. 1952)), *Hvordan gikk det?* (Available in English: *How did it go?*)
 - 2) Kari Stai (2008), *Jakob & Neikob* (available in English: *Yesper & Noper*)
 - 3) Lisa Aisato (2014), *En fisk til Luna* (*A fish for Luna* [not available in English])
 - 4) Charlotte Bråthen and Markhus (2013): *Frøet* (*The seed* [not available in English])

The selection of the four titles was based on the following selection criteria:

- the titles are available in Norwegian, in print and app format
- there is ample potential in the story and the text for rich dialogues
- the apps display a variety of interactive options
- the books and apps are of high linguistic and aesthetic quality
- the theme/topic/content in the stories is relevant for both boys and girls and age-appropriate (age 4–5 years)
- the books and apps display a diverse verbal language from simple words and sentences to more complex language in which the wording might generate curiosity and invite readers to explore vocabulary, metaphors, etc.

Rich descriptions of all four titles (in both media) were developed, providing detailed page-by-page descriptions of the narrative (text), the iconotext, semiotic resources and aesthetic characteristics, as well as a complete inventory of interactive options and digital enhancements for the apps. Two of the four picture book apps – *How did it go?* and *Yesper & Noper* – are characterized by a high degree of interactivity (i.e., many hot spots to activate and abundance of interaction possibilities). In contrast, *A fish for Luna* and *The*

seed have no hotspots and only limited audiovisual enhancements (e.g., animations, ambient sound). This combination of high- vs low-interactivity apps was deliberate and motivated by the objective to observe a wide range of interactivity.

3.2. Participants and ethics

Twelve teachers, 72 children ($M = 57.2$ months, $SD = 7.9$; min. = 37, max. = 69) and their parents/caretakers participated in this study. Participants were recruited by means of an invitation letter from the head of the Department of kindergarten and adolescence in the collaborating municipality. At the outset, thirteen kindergartens signed up to participate in the study, but one withdrew before project started. Hence, twelve teachers in six kindergartens signed up to participate in the video observed reading sessions. In addition, fourteen teachers in six other kindergartens participated in piloting the questionnaires prior to the video data collection. All teachers were professionally educated kindergarten teachers.

In compliance with guidelines from the Norwegian National Research Ethics Committee (NESH: <https://www.etikkom.no/en/our-work/about-us/the-national-committee-for-research-ethics-in-the-social-sciences-and-the-humanities-nesh/>) and the EU General Data Protection Regulation (GDPR: <https://eugdpr.org/>), several steps were taken to ensure that all ethics requirements have been fulfilled. All participating teachers and all parents/caretakers for all 72 children in the study signed an informed written consent prior to the data collection. In addition, the teacher explicitly asked each child individually before the video-observation was carried out, whether or not he or she wanted to participate in the session. The children were also informed that they could at any time opt out of the study. The study is approved by The Norwegian Social Science Data Service (NSD), a third-party research ethics agency. All ethical requirements have been followed during all phases of the study. Since the data material includes video recordings of children, the ethics regulations are particularly strict. Therefore, the video data produced in VEBB is stored on an external, password-protected server with restricted access (TSD⁵).

4. Methods and procedure

Prior to the video observation study, questionnaires were administered to parents/primary caregivers and kindergarten teachers. These assessed a range of aspects related to children's reading experiences and preferences, experiences with digital technologies, access to technologies in kindergarten and at home, reading cultures in kindergarten and at home, children's interest in language-related activities, and demographic information (see Appendix for full list of items).

All teachers who participated in the intervention received training in the shared, dialogue-based reading method six months prior to the data collection. During this period, the teachers were asked to read back-listed picture book apps with the children, in order to minimize a potential novelty effect of the tablets. The apps selected for the data collection were unknown (and unavailable) to the teachers and the children before the video-recorded sessions.

Video data collection:

Twelve teachers carried out four reading sessions each (making the total number of video-recorded sessions 48). During a period of three weeks, each teacher read two titles (*Yesper & Noper + How did it go?* OR *Luna + The seed*) with a group of maximum six children, one time in the print book version and one time in the app version. In order to minimize repetition effects, there was a minimum of three days between each video-recorded reading session. The distribution was set up to ensure that all four titles were read by three teachers, with title and medium counterbalanced.

Sessions were recorded by the teachers, using Zoom Q4 and Zoom Q8 video cameras. This type of camera has an integrated microphone that is powerful enough to capture voices and other audio information, thus making them suitable to use in video observation studies in which dialogue is essential. In order to allow identification of the same child across sessions, all children wore a number tag (the number was the same in all four sessions).

Developing the codebook

The VEBB coding scheme was inspired by previous studies of children's engagement with picture book apps (Merchant, 2015; Roskos, Burstein, & You, 2012), and adapted to the purposes of VEBB. In particular, both verbal and non-verbal (i.e., multisensory) engagement is included, in order to account for the multiple outcomes of the interaction between the medium, the narrative, the children and the teacher (Mangen, Hoel, & Moser, 2019). Moreover, the coding scheme is developed to reflect the purposes of SDBR in group reading sessions.

Roskos et al. (2012) have developed a typology for observing engagement with e-books in different formats (shared book; independent book browsing) and across devices (stationary and handheld touch screens). The typology builds on learning theory and early literacy research (print and digital), with focus on verbal interaction, eye movements and haptic interactions. The typology contains three categories and eleven salient behaviors of children's engagement with e-books: "(a) control as indicated by positioning and operation at the touchscreen (operating the control buttons); (b) multi-sensory behaviors, such as touching; and (c) communication involving verbal and nonverbal behaviors, such as talking and smiling" (Roskos et al., 2012, p. 52). In their study, Roskos et al. apply this typology to video observations from an Early Reading First classroom setting, to obtain descriptive observations of children's engagement with e-books in teacher led reading at the stationary touch screen and child-led reading with handheld devices.

In his close analysis of young children (14–22 months) in two story-app sharing interactions with an adult, Merchant (Merchant,

⁵ Services for Sensitive Data: <https://www.uio.no/english/services/it/research/sensitive-data/index.html>

2015) focuses more thoroughly on the materiality and touch-screen interface of the iPad (see also Merchant, 2017). Merchant (2015) designs a framework to identify “the work of the body and the hands based on the different functions they perform” (Merchant, 2015, p. 5), distinguishing between (1) Stabilizing movements (holding; holding and resting), (2) Control movements (tapping; swiping), and (3) Deictic movements (pointing to direct attention).

These two studies are the main theoretical inspirations underlying the coding construct/scheme of VEBB. Yet, issues related to context (the number of children attending, the children’s age, reading interests as well as different curricular approaches) have motivated adaptation of the codes applied in Roskos et al. (2012) and Merchant (2015) to the purposes of the present study. Whereas Roskos et al.’s (2012) study is conducted within Early Reading First classroom settings, VEBB is situated as SDBR in groups of up to six children. Both these studies differ from the dyadic readings in Merchant’s (2015) study. Moreover, in VEBB, the teacher is responsible for organizing the group session (e.g., their own and the children’s position in relation to the device; their own position in relation to the children; the children’s position in relation to peers). Importantly, this makes it possible for the teacher to allow – or to prevent – more children to access, and interact with, the medium (Tønnessen & Hoel, 2019).

In the VEBB video-data coding scheme, there are two main classes of codes: Duration (DUR) codes and Non-Duration (or Frequency) (FREQ) codes. Duration codes register how long a phenomenon lasts, from onset to offset. The Non-Duration (Frequency) codes register instances, how often something happens. Frequency codes may appear both inside and outside of the Duration codes. Within the Duration class, there are four single codes and within the Non-Duration or Frequency class, there are four single codes. All frequency codes are linked to either child or teacher, hence, it is possible to identify whether the children or the teacher is the active part.

Thematically, the codes from the two classes sort into the three categories: Medium Affordances, Multisensory Engagement and Verbal Engagement.

MEDIUM AFFORDANCES

- (I) NARRATOR (DUR)
- (II) SOUNDSCAPE (DUR)

MULTISENSORY ENGAGEMENT

- (I) POINT MEDIUM (FREQ), linked to Child or Teacher
- (II) TOUCH MEDIUM (FREQ), linked to Child or Teacher

VERBAL ENGAGEMENT

- (I) PRE-UNDERSTANDING (DUR)
- (II) DIALOGUE (DUR)
- (III) UTTERANCES ABOUT THE NARRATIVE (FREQ), linked to Child or Teacher
- (IV) UTTERANCES ABOUT THE MEDIUM (FREQ), linked to Child or Teacher

See Table 1 (below) for elaboration and exemplifications of all codes:

The following illustrations may be helpful in distinguishing between pointing towards, and touching, the medium in book and app conditions respectively (Figs. 1–3):

Coding procedure

The 48 films were randomly distributed to four coders, who performed the coding independently of each other, applying all codes in the original version of the codebook. The video data were entered into INTERACT⁶ video analysis program (Mangold, 2010, Lab Suite Version, Program Version 16.4.0.56). To check inter-coder agreement, independent coding of four films (equaling 8–10% of the total material) was completed.

Calculating KAPPA in the INTERACT video analysis program required the following reorganization and simplification of the original VEBB coding scheme: Firstly, all Duration codes were collapsed into one class (Duration), and all Frequency codes were collapsed into another class (Non-Duration). Secondly, the person variables were simplified: individual child variables (“Child 1”, “Child 2”, etc.) were recoded into one group variable, “Children”, the reason for the simplification being that what is important is not which child does or says what, but whether it is a child (or children) or the teacher who says or does something. Thirdly, three codes (“Page”; “Technical Adjustment”; “Reading Context”) were excluded from the data material because they will not be used in further analyses. Finally, the category of verbal utterance originally coded as “Fabulize”, denoting utterances reflecting free associations prompted by the narrative, was recoded into “Narrative”, resulting in two main categories of verbal utterances: “Medium” and “Narrative”. The theoretical rationale for this recoding stems from the main objective of the study, which is to distinguish between two main types of dialogue: that related to various aspects of the content of the story (“Narrative”), and that related to any aspect of the affordances of the medium (picture book or iPad; “Medium”).

The four films to be coded for the inter-coder agreement check, were coded independently by two researchers who had not previously been coding that film. Hence, four researchers have re-coded films they haven’t coded before. Inter-rater reliability

⁶ INTERACT is a commercial video coding and analysis software for observational studies that can be used as an interface for any coding scheme.

Table 1
Definition of codes with examples.

Code	Definition	Example Picturebook App <i>Yesper and Noper</i> (101appJA4), total time spent on SDBR: 22 min.	Example Print book <i>Yesper and Noper</i> (101bokJA2), total time spent on SDBR: 27 min.
MEDIUM AFFORDANCES			
(I) Narrator (dur)	The narrator's voice can be either the digital reading of the app, or the teacher reading the text in the book or app aloud. When the teacher recounts the story with own words or in dialogue with the children about the story, this is coded as (VII) <i>Dialogue</i> .	Recorded voice narrating the story. Total play time 7 minutes.	Teacher reading the story
(II) Soundscape (dur)	Continuous sound in the app	Introduction song, not activated in this reading	Not relevant
MULTISENSORY ENGAGEMENT			
(III) Point medium (freq), linked to Child or Teacher	Teacher or child points to/in the book or the tablet, with the whole hand or with a finger.	Figure 1_app point	Figure 2_print point
(IV) Touch Medium (freq), linked to Child or Teacher	Teacher or child physically touches the tablet, i.e. to search for or touch to activate hot spots. Turning pages is not included.	Figure 3_app touch	Not relevant
VERBAL ENGAGEMENT			
(V) Pre-understanding (dur)	The time spent on establishing shared focus before the reading starts: concerning expectations and background knowledge related to the story, the medium and/or the participation.	One minute spent on getting to know the main characters by pressing the hotspots: Yesper says "Yes" and Noper says "No".	Four minutes spent on talking about the iconotext (characters, expressions, shapes, colors), the popularity of the book and the author.
(VI) Dialogue (dur)	Exchange of opinions, impressions and thoughts where the expressions are interrelated, including responses over several turns	Nine occurrences, total time 3 minutes, extract of turn taking: Teacher: Do you remember, what happened here? Child: He says "No". Teacher: Why did they make a wall? Child: Because, because they made a room so they couldn't argue. Teacher: Yes, why? Child: Because Jacob got all the things he wanted. Teacher: He just said yes when someone would sell lamps to him. Then they made a wall.	33 occurrences, total time 13 minutes, extract of turn taking: Teacher: What do you think he is doing? Children: He cut the house in two! Teacher: He cut the house in two. But what does he do here? Children: He covers his ears. Teacher: What happens when we cover our ears? Children: Because he beat the drums so very, very, very loud. Teacher: Yes, he beats the drums loudly. But what happens when we cover our ears? Children: Because he think it's so noisy. Children: Then we hear nothing. Teacher: Yes, because then it won't be so noisy. Then we shut the sound out. Total amount: 175. Teacher: 77. Children: 98. Extract of utterances: Teacher: "What do you think Yesper says?" Child: "It looks like a labyrinth."
(VII) Utterances about the narrative (freq), linked to Child or Teacher	Teacher or child comment on the narrative (the verbal content, illustrations, animations, and audi expressions). Also utterances going beyond here-and-now, like imaginations and associations.	Total amount: 113. Teacher: 60. Children: 53. Extract of utterances: Teacher: "He was a clever guy." Child: "He said: 'Hello, I don't want to be with you.'"	Total amount: 175. Teacher: 77. Children: 98. Extract of utterances: Teacher: "What do you think Yesper says?" Child: "It looks like a labyrinth."
(VIII) Utterances about the medium (freq), linked to Child or Teacher	Teacher or child comment on lack of view; to get a better view; questions about where to click; when and who can click; negotiations on turn-taking.	Total amount: 100. Teacher: 71. Children: 29. Extract of utterances: Teacher: "You can tap first." Child: "No, it was my turn to tap.", "I also want to try."	Total amount: 7. Teacher: 6. Children: 1. Extract of utterances: Teacher: "This is the last page." Child: "Aren't you going to read now?"

(Cohen's Kappa; Cohen, 1960) for two raters was calculated applying the *Inter Rater Reliability Check* offered by the INTERACT software (Mangold, 2010, p. 191ff.), with the following parameters for both Duration Codes and Frequency Codes: Criteria for matches were set to an overlap of at least 75% with a tolerance window of four seconds. Criteria for mismatches were set to at least 50% overlap if their onsets are within the tolerance window of two seconds (for details on how to calculate Kappa in INTERACT, see "Kappa parameters" in Mangold, 2010, p. 192ff.). For the Frequency Codes, Kappa reached a level of $\kappa = .71$, and $\kappa = .60$ for the Duration Codes. According to the literature, Cohen's Kappa of this size can be considered as *acceptable* (.50–.70; see e.g. Field, 2018, p. 823), *moderate* (.60–.79; see e.g. McHugh, 2012) or *substantial* (.61–.80; see e.g. Landis & Koch, 1977).

ANALYSIS PLAN

Outcome measures

The *primary outcome measures* for VEBB are the video observations, in particular associations between the following events:



Fig. 1. Pointing in the app condition.



Fig. 2. Pointing in the book condition.

- nonverbal engagement (FREQ: Pointing; Touching) and dialogue (DUR) across medium
- nonverbal engagement (FREQ; Pointing; Touching) and types of utterances (FREQ: Narrative; Medium) across Medium (picture book; iPad).

Data analysis will be conducted in SPSS version 25 (IBM). At a descriptive level, the patterns of responses to various media will be provided by mean values and standard deviations (frequency and duration). Differences in the dependent variables (nonverbal engagement; dialogues; type of utterances) between the two media (picture book; iPad). will be explored by variance analyses (two-way MANOVA). A power analysis (G*Power, [Faul, Erdfelder, Lang, & Buchner, 2007](#), MANOVA Global effects) revealed that we, based on a sample of 72 children, can obtain statistical power ($1-\beta$) about = 0.8, which, according to [Cohen \(1988\)](#), can be considered as satisfactory.

On a *between medium level*, it is anticipated that reading with picture book apps will yield less dialogue (quantitative measure) than reading with print picture books.

Qualitatively, we predict that the highly interactive apps will result in more utterances about medium than about narrative, and more multisensory engagement (in particular, TouchMedium) whereas low-interactive apps will result in a better balance of utterances about medium and narrative.

The VEBB coding scheme further invites more fine-grained distinctions of verbal and non-verbal engagement in that utterances or



Fig. 3. Touching in the app condition.

multisensory engagement is linked to children or teacher. This allows a more nuanced exploration of the associations between the verbal and the non-verbal engagement in a reading session overall, and sheds light on how the affordances of various media may differently affect the dialogue during SDBR – qualitatively (type of utterances) as well as quantitatively (duration of dialogue).

Findings from video observation data will be supplemented by findings from *secondary outcome measures* (viz., the questionnaires, reflection logs, focus group interviews) in order to address a number of questions, e.g.:

- i) Children's responses after reading sessions (measured by a questionnaire using smileys, administered by the teacher):
 - do children's responses differ depending on the medium used in the reading session?
 - how do children's responses correspond with the degree of interactivity in the different apps?
 - is there a difference between children's experiences depending on whether they read the book version or the app version of a title, first?
- ii) background questionnaires to teachers:
 - are there any associations between a teacher's pre-understanding and/or motivation to apply digital technologies when reading with children, and the ways in which they read with the children as observed in the video recorded sessions?
 - how do teachers' responses correspond with those of the parents' with respect to children's language performance and interest?
- iii) background questionnaire to parents:
 - are there any associations between reading culture at home and children's reading engagement (as observed in the video study) and/or children's responses about engagement immediately after reading sessions (as measured with the survey)?
- iv) teachers' didactic reflection logs:
 - is there any pattern in teachers' evaluation of the different apps for pedagogical purposes?
 - how do teachers plan the reading session with iPads compared to with print books?
 - in light of the goals, how do teachers evaluate their own reading session?
 - do teachers' perceptions and evaluations of the pedagogical potential of picture book apps for reading with children change across the reading sessions?
- v) focus group interviews:
 - what are teachers' perspectives and reflections on the use of digital technologies for reading with children in kindergarten? Have these changed during their participation in the project?

Correlation analysis, multiple linear regression and multi-level modelling will be used to analyze these relationships (mainly i-iii). Qualitative in depth analyses will generate specific knowledge to support, elaborate and enrich the interpretation and discussion of the quantitative findings (iv-v).

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.ijer.2019.07.002>.

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