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ORIGINAL ARTICLE

Enhancing Storytelling Activities to Support Early (Digital) Literacy Development in Early Childhood Education

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Abstract

When storytelling is combined with play-based activities, it can provide an effective stimulus for early literacy. The present study investigated the effects of a structured storytelling approach on the development of young children's literacy and digital literacy skills. Three classes in two public kindergartens participated in an experimental study involving 62 children, aged 5–6 years. Each classroom was assigned to one of three experimental conditions. In one classroom, the children engaged in their regular literacy activities. In a second classroom, literacy development was supported with storytelling and associated play-based activities, while in the third classroom, children engaged in digital storytelling and activities. Outcomes were assessed by tests of early literacy and digital literacy skills before and after the 6-week intervention. The findings showed that both storytelling conditions significantly enhanced children's literacy and digital literacy skills. Structured storytelling activities provide a viable and valuable way to enhance literacy and digital literacy in early childhood education.

Keywords Storytelling · Digital storytelling · Emergent literacy · Digital literacy · Early childhood education

Résumé

Lorsque le récit d'histoires est combiné à des activités ludiques, il peut constituer un stimulus efficace d'alphabétisation en jeune enfance. La présente étude a examiné les effets d'une approche structurée de la narration d'histoires sur le développement de compétences en littératie et numératie chez de jeunes enfants. Trois classes de deux maternelles publiques ont participé à une étude expérimentale menée auprès de 62 enfants âgés de 5 à 6 ans. Chaque classe a été affectée à l'une de trois condi-

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tions expérimentales. Dans une classe, les enfants ont participé à leurs activités de littératie habituelles. Dans une deuxième classe, le développement de la littératie était soutenu par la narration d'histoires et associé à des activités de jeu, tandis que dans la troisième classe, les enfants ont participé à des récits d'histoires et à des activités informatisés. Les résultats ont été évalués par des tests de compétences préscolaires en littératie et numératie avant et après l'intervention de 6 semaines. Les résultats montrent que les deux conditions expérimentales de récits d'histoires ont significativement amélioré les compétences des enfants en matière de littératie et numératie. Des activités structurées de narration d'histoires constituent un moyen viable et précieux d'améliorer la littératie et la littératie numérique en éducation de la petite enfance.

Resumen

La incorporación de cuentos en las actividades lúdicas puede brindar un estímulo efectivo en la educación de lectoescritura en niños de preescolar. El presente estudio investigó los efectos de un método estructurado de cuentos en el desarrollo de habilidades de lectoescritura y lectoescritura digital en niños pequeños. Tres clases de dos grupos de kínder en instituciones públicas participaron en un estudio experimental que incluyó 62 niños en edades entre 5 y 6 años. A cada salón de clase se le asignó una de las tres condiciones experimentales. En un salón de clase, los niños participaron en sus actividades normales de lectoescritura. En el segundo salón de clase, el desarrollo de lectoescritura se apoyó en actividades de cuentos, mientras que en el tercer salón de clase los niños participaron en actividades de cuentos digitales. Los resultados de la intervención fueron evaluados mediante pruebas de habilidades de lectoescritura temprana y de lectoescritura digital antes y después de la intervención de seis semanas. Los hallazgos mostraron que ambas condiciones experimentales mejoraron significativamente las habilidades de lectoescritura y lectoescritura digital de los niños. Las actividades estructuradas que incorporan cuentos brindan una forma viable y valiosa para mejorar la lectoescritura y lectoescritura digital en la educación infantil temprana.

Introduction

Literacy skills in early childhood contribute to the acquisition of reading and writing skills (Brown 2014) and contribute to overall academic achievement across the school years (McConnell and Wackerle-Hollman 2016). Such findings have led to a focus on supporting literacy development in kindergarten. Most of these efforts have involved academically oriented programs in which much of the available school day is allocated to drill and practice exercises in individual, small-, and large-group contexts (Golbeck 2001). The challenge taken up in the present study is to develop an effective, child-friendly approach to support young children's literacy development.

While many programs that have focused on drill and practice exercise in individual, small-, and large-group contexts have effectively raised the literacy skills of kindergarten children (McGill-Franzen 2006; Teale et al. 2018), the use of formal instruction in early childhood has been continually debated (Marcon 1999;

Nicolopoulou et al. 2006; Wood and Hedges 2016). Gallant (2009) also highlighted the importance of having children's activities as natural as possible, instead of having formal table-top activities, to support children's engagement in learning.

Supporting digital literacy skills development is also of paramount importance in today's world. There have been a rapid and significant increases in the access to, and use of, mobile devices for young children (Miller et al. 2017; Chang et al. 2018). Young children are growing up in environments where mobile phones, tablets, and other forms of digital devices are features of daily communication. Children need to become skilled in handling these digital forms of communication. Literacy development can no longer be limited to traditional text-based reading and writing. It should also include digitized reading and writing which we will call, henceforth, digital literacy development. It is not surprising that a recent report from UNESCO (2018) emphasized the importance of support for pleaded literacy and digital literacy in early childhood education.

The present study describes a series of activities specifically designed to support literacy and digital literacy development in early childhood education. The activities revolved around a structured storytelling approach that essentially consisted of a 6-week intervention. To assess learning, a set of early literacy and early digital literacy measures were developed and administered before and after the intervention. To our knowledge, the approach of creating a series of activities that blend a more formal type of instruction with storytelling, and assessing the effects on literacy and digital skills in early childhood education is a novel one.

Storytelling

Storytelling is a process in which a person uses vocalization, narrative structure, and mental imagery to communicate with an audience (Peck 1989). The use of storytelling in early childhood education has been widely encouraged because it is entertaining and seen as a natural way of teaching and learning with young children (Cremin et al. 2018). Moreover, empirical research reveals that storytelling enables processes such as language interaction (Lucarevschi 2016), imagination stimulation (Bežilová 2019), and cognitive engagement (Phillips 2000) that have been found to contribute to literacy skills development. Lisenbee and Ford (2018) argue that a proper story entails five key literary elements, namely setting, theme, characters, plot, and conflict. When these elements are properly addressed, it develops a story schema that supports comprehension (Stevens et al. 2010), and hence, storytelling is a good way to deliver content, and provide learning guidance in an interesting and personal way (Kolucki and Lemish 2011).

So far, the design of an effective storytelling approach in early childhood education has remained elusive. Stories appear to have been underused for what they can do. They are mainly employed merely for gaining children's attention at the beginning of a classroom activity or for moments of relaxation after the main task has been completed (Roslan 2008). Thus, it appears that storytelling has yet to prove itself as an activity that can contribute to learning at school.

Cooper (2005) proposed in favor of an approach in which storytelling is complemented with play-based activities. According to this view, storytelling should provide the core information; the storytelling component should engage the children in affective and cognitive experiences around language, print, and stories. During storytelling, the teacher can provide guidance by interacting with the children. The storytelling should be followed by play-based activities in which children can hone their literacy skills. These activities should involve the children in meaningful encounters with letters, sounds, and writing. Cooper argued for an instructional structure in which a storytelling approach is infused by play-based activities. Such an approach turns storytelling into a meaningful and pleasant way for creating a structured, child-friendly stimulus for literacy development in early childhood education.

Digital Storytelling

For many years, storytelling approaches in early childhood education have been limited to traditional forms of text-based reading and writing in which other resources such as puppets, or story-related objects and digitized media were used only occasionally (Boltman and Druin 2003). Technological advances have dramatically raised the affordance for enriched storytelling and thereby the possibility of making it more engaging in its own way. The digital tools needed for storytelling—computers, smart phones, audio capture devices—have become more accessible. In addition, a huge number of powerful, yet simple storytelling software programs are now available. The combination of oral storytelling with audio, images, and various digital tools has led to what is now called digital storytelling (Barber 2016).

Digital storytelling means using technology properly to tell a story. To create a digitized story, designers should pay special attention to personalization (Robin 2008). Digital storytelling should adopt a specific point of view, contain a dramatic question, and have emotional content to personalize the content of the story. Moreover, in digital storytelling the gift of voice, power of soundtrack, economy, and pacing need to be attended in design to personalize the delivery of the story. All together, these make up the seven elements or features of digital storytelling (Robin 2008).

The proper usage of these digital elements can contribute to making content more understandable and motivating for young children (e.g., Boerma et al. 2016). Indeed, the elements of economy and gift of voice can be linked to multimedia principles that have been proven to enhance learning (Mayer 2009). The element of economy is related to the coherence, redundancy, modality, and multimedia principles. While, the element of the gift of voice is related to the personalization and voice principles. When digital storytelling is used in early childhood education, the effect may be that it familiarizes children with digital media.

Measurement of Early Literacy

Literacy is commonly seen as a set of tangible skills, particularly the cognitive skills of reading and writing. These skills are independent of the context in which such

skills are acquired, and of the background of the person who acquires the skills (UNESCO 2005). Literacy in early childhood has proven to be significantly related to later reading and writing ability, and long-term academic outcomes (Ritchey 2008). Early literacy is the precursor to conventional forms of reading and writing (Whitehurst and Lonigan 1998).

Literacy skills in kindergarten include a number of early skills of awareness and exploration for reading and writing that develop in increasingly complex ways (Missall et al. 2008). These skills include constrained and unconstrained components (Paris 2005). Constrained components are also known as technical or decoding skills. Examples include letter knowledge, phonics, and concepts of print. These skills are necessary, but not sufficient, for full literacy. They are best taught and measured systematically as part of a comprehensive language and literacy program. Unconstrained components are meaning-based skills. Examples are oral language, vocabulary, and comprehension. These skills are developed across a person's lifetime and require meaningful routines and opportunities for practice.

Children's literacy skills, especially the constrained skills, are expected to meet normative levels for their age group. Assessing these benchmarks allows one to ascertain where a child needs literacy training. The early literacy measures in this study assessed four key skills of early reading and writing, namely name writing, alphabet knowledge, phonological awareness, and print awareness. These skills can be found in various other early childhood literacy measures (e.g., Bowles et al. 2014; Moyle et al. 2013; Puranik et al. 2013).

Measurement of Early Digital Literacy

Along with an increasing role of digital technology in children's lives, comes the call for literacy development that extends beyond the traditional areas of reading and writing. There is a need for survival skills in the digital era, or what is now known as digital literacy (Eshet 2012). Digital literacy involves a complex set of component skills that include the ability to identify, understand, interpret, create, and communicate texts that are written, printed and digital (UNESCO 2005). Neumann et al. (2017) described emergent digital literacy as the skills, knowledge, and attitudes which are the developmental precursors of digital literacy. Ng (2015) described digital literacy as "the integrated cognitive, technical, and social–emotional ability of an individual to competently use digital technologies across the various contexts of life" (p. 129).

Relatively little is known about the development of these precursors of digital literacy skills (Kennedy et al. 2012; Marsh 2006). In this study, the measurement of early digital literacy skills is derived from Ng's (2015) distinction between a technical, cognitive, and socio-emotional dimensions. Following the dynamic trend of digital devices usage, the technical dimension is the most developed research focus in digital literacy for childhood education. The skills in the technical dimension revolve around the ability to operate digital technologies and their functional features. Most research has measured children's digital literacy by recording whether or not there was skilled usage of digital devices, such as computers (with internet) (Ba

et al. 2002), or tablets and mobile phones (with apps) (Marsh 2016; Neumann and Neumann 2017; Oakley et al. 2018; Ozturk and Ohi 2018). Most of these studies involved primary school (6–10 years of age).

While the precise nature of children's experience with technology tools in early childhood is still in debate, NAEYC and Fred Rogers Center for Early Learning and Children's Media (NAEYC 2012) suggested that digital media should be used to enhance children's cognitive and social abilities in order to be able to strengthen the understanding of the appropriate use of digital media later in life. The technical skills required will always be changing along with the evolving digital devices, while the other dimensions relatively stays the same. Therefore, the present study did not assess technical skills development, but focused instead on skills development as far as the cognitive and social–emotional dimensions.

Measurement approach to Ng's (2015) cognitive and social–emotional dimensions of early digital literacy are still relatively absent although researchers other than Ng have argued for their relevance (Marsh et al. 2018). The cognitive dimension involves critical thinking and multimodality. The representation afforded by digital technologies can be multimodal—dominated by visuals (Ng 2015). These become familiar modes of representation and are crucial for accessing information critically and creating knowledge (Beatty 2013). The socio-emotional dimension involves communication and social skills. This dimension emphasizes the importance of understanding and protecting one's own safety and privacy while communicating and socializing digitally. The measures used in this study assessed these two dimensions of digital literacy.

The Current Study

The research presented employs a quasi-experimental design with three conditions. In the control condition, children engaged in regular literacy development activities, which revolved mainly around drill and practice activities for reading and writing. In the two experimental conditions, children engaged in structured activities embedded with storytelling or digital storytelling and structured activities relevant to the story. Two research questions were addressed:

- How does *early literacy development* in the two storytelling conditions compare with such development for the control condition?
- How does *early digital literacy development* in the two storytelling conditions compare with such development for the control condition?

A previous study studied the same questions (Maureen et al. 2018). The present study involves a more extensive intervention. This intervention included six units spread over a six-week period, compared to three units in the previous study. This extended time for the intervention was made to address any possible novelty effect of the storytelling activities. In addition, it allowed us to investigate whether more prolonged exposure to structured storytelling activities would also yield as large a learning gain, as found in the previous study.

In relation to the first research question, it was predicted that the storytelling condition (S) and the digital storytelling condition (DS) would provide stronger support than would the control condition (C). No difference for literacy development was expected between the two experimental conditions. In relation to the second research question, the previous study explored the digital literacy development for all children in the study, across three classrooms. It was expected that the outcome would substantiate the previous, tentative finding of stronger outcomes for digital storytelling, followed by the storytelling condition, and then the control condition.

Methods

The study was conducted in three classrooms from two public kindergartens in Indonesia. The 62 participants (30 girls and 32 boys) in this study were 5- and 6-year-old children with an average age of 5.58 years ($SD = 0.5$). Intact classrooms were randomly assigned to conditions. This led to the following groups: Control ($N = 18$), Storytelling ($N = 24$), and Digital Storytelling ($N = 20$).

Instructional Materials

The materials were six units of storytelling activities: My Name, My Body, My Hobby, My Friends, My Birthday, and My Senses. Each unit was conducted during one day once a week. These units revolved around common themes that are addressed in the beginning of the academic year during the time this study took place. Each unit had two or three objectives that aimed to contribute to early literacy or early digital literacy skills development. These objectives become the main lines in the storytelling and also in the follow-up activities. The construction of the activities in the units was based on Gagné's events of instruction (Smith and Ragan 2005).

Each unit had a four-part structure: (a) circle time opening (30 min.), (b) (digital) storytelling (30 min.), (c) follow-up activities (60 min.) and (d) circle time closure (30 min.). The detailed set-up of a unit is illustrated with the theme of "My Body." The objectives of this unit were (a) recognizing own identity and (b) recognizing daily words related to body parts. Table 1 shows how (digital) storytelling and Gagné's events of instruction were blended in the unit.

Child Assessments

Early Literacy Measures

The scoring in the Early Literacy test is based on a rubric with the following component skills: (1) Name writing (2) Recognizing uppercase letters, (3) Recognizing lowercase letters, (4) Identifying the initial sound of words, (5) Recognizing names in written form, (6) Recognizing daily words; scores could vary between 0 and 4 points (see "Appendix 1").

Table 1 An illustration of the blend between (digital) storytelling and Gagné's events of instruction

Gagné's events of instructions	Classroom sessions
Circle time—opening (30 min)	
1. Gain attention	Engagement in morning routine
2. Inform learners of the objectives	Teacher tells the children about the theme and objective of the day
3. Stimulate recall of prior learning	Sing parts of body song Trace own name on a health card
(Digital) storytelling (30 min)	
4. Present the content	Teacher tells the rules for the session and some identification of the story Teacher tells the story or plays the digital story via a projection device
5. Provide learning guidance	Teacher leads a discussion about the different parts of the story and how it relate to the activities at the rest of the day
Follow-up activities (60 min)	
6. Elicit performance	Play with balls with name labels
7. Provide feedback	Play with sets of doctor role play
Circle time—closure (30 min)	
8. Assess performance	Create bacteria monsters and present them to the class
9. Enhance retention and transfer	Teacher reviews the story and summarizes activities of the day

Name Writing Children's own names are often the first words they are taught to recognize and write (Dunsmuir and Blatchford 2004). Name writing skills is a developmental process that begins with pre-alphabetic forms, and involves print concepts, letter identification, letter reproduction (Puranik et al. 2011), and knowledge of letter-sound correspondence (Cardoso-Martins et al. 2011).

Assessment of this skill involved: first, a child was asked to write her/his first name at a booklet cover. If the child said that (s)he could not write it down, the examiner would show the prepared example. The child was rated depending on the level of help required and competence in this writing task (see "Appendix 1").

Alphabet Knowledge Alphabet knowledge is a key of early literacy skill (Powell et al. 2008). It can be defined as the ability to distinguish the shapes and names of the letters in the alphabet (Puranik et al. 2014). There is an ongoing debate on what precedes the other and accordingly which component skill should be taught first. Some teachers prefer to begin with the uppercase because it is easier to distinguish the shapes of each letter (Bowles et al. 2014) while others prefer to start with lowercase because there are more lowercase letters in a common text. In this study, both uppercase and lowercase letters were tested with separate pages.

Assessment of this skill involved: First, the child was shown a single page with the 26 letters of the alphabet presented in scrambled sequence. Next, the experimenter pointed to each letter, and asked the child to name it. Responses were scored as correct, incorrect, or no response. More letters yielded more points.

Phonological Awareness Phonological awareness is an awareness of sounds in spoken words (Demont and Gombert 1996). Successful efforts to train phonological awareness have led to significant achievement differences in reading acquisition (Anthony and Francis 2005). In other studies, phonological awareness has been measured, and consequently defined, by many different tasks. The common feature of these tasks is isolating single sounds from words (e.g., What is the first sound in "fish"?).

Assessment of this skill involved: The stimulus material consisted of nineteen words from daily life, each consisting of two to three syllables. Each word was read aloud to a child who should then mention the first sound of that word. Before actual testing, the child was given two practice items to acquaint them to reproducing the sound rather than state the name of the letter. If the child failed to identify the initial sound of the first word, the next word would be asked. If the child did not get any sounds correct in the first five words, the assessment was discontinued.

Print Awareness Print awareness refers to the forms, conventions and functions of print (Justice and Ezell 2001). It includes conceptual knowledge about print forms, print concepts and book concepts. Print awareness is a skill that develops both naturally in time and through environmental factors (Çetin 2014).

Assessment of this skill involved: The first feature was recognizing names in printed form, so the stimulus material was the name list of the children in the classroom. Each child was asked to point and state the name(s) she/he recognized. The more names stated correctly, the higher the score. The second stimulus material consisted of twenty words from daily life. The child would get a score depending on the number of words (s)he could read.

This Early Literacy test was a slightly extended version of the test used in the previous study (Maureen et al. 2018). The only difference was that alphabet recognition was split into an item on lowercase and capital letters. In the previous study, satisfactory for pretest ($\alpha = 0.63$) and posttest ($\alpha = 0.79$) were reported. In the present study, the Early Literacy test was also administered before and after the intervention. Reliability analyses using Cronbach's alpha showed good scores for both the pretest ($\alpha = 0.91$) and posttest ($\alpha = 0.84$).

Early Digital Literacy Measures

The early digital literacy measures assessed prerequisite skills in cognitive and social–emotional dimensions of digital literacy. To our knowledge, the research literature has not yet devised assessment measures for these facets of digital literacy for kindergarten-aged children. The scoring of the Early Digital Literacy test itself is based on of a rubric with the following component skills: (1) Plan an event, (2) Read a picture, (3) Predict an event, (4) Recognize own identity, (5) State conversation rules, (6) Engage in a conversation (see "Appendix 2").

Cognitive Skills Critical and multimodal thinking are two relevant skills from the cognitive dimension in digital literacy development (Ng 2015). In early childhood, critical thinking is supported by enhancing the children's ability to plan (Epstein 2003) and to predict (Brosseau-Liard 2017). Multimodal thinking in early childhood includes the ability to "read" a picture. These are three test items for the cognitive skills dimension. The first is planning an event. The second concerns the child's ability to identify a picture in a story book. The third feature is predicting an event based on a book illustration.

This skill assessment varied across the three item types. To assess event planning, the child was asked to tell his or her desires for the next birthday party. The presence of a particular type of information (e.g., what, who, where, when, how, why) in the child's response yielded a score of 1 point. The stimulus material in the second and third items was a flap book about a dog, *Spot* (Hill 2005). To measure the ability to read a picture, the child was shown a picture from the book and asked to name the objects that were displayed. If the child could name 1–2 things from the picture, (s)he would be asked to make a picture-based inference (e.g., What do you think the story is about?) for a higher score. To measure the ability to predict, the experimenter would present a picture and ask the child to guess what might happen next. If the child could not give any prediction, the experimenter would give some clues (e.g., You said that you saw this and that, so what do you think happens on the next page?). The child got a higher score if (s) he could make a prediction without any clue.

Social–Emotional Skills The social–emotional skills measured in digital literacy involved items that concerned the child's ability to communicate about his/herself to others through digital platforms (Ng 2015). In early childhood, an important aspect of this facet concerns gaining a sense of self-identity (Marsh et al. 2005). For young children, the development of self-identity includes getting to know their own name, age, and gender. There are three test items for this competency. The first item concerns recognizing their own identity (including full name, age, and birthday). The second and third item concern conversations. Item two refers to the ability to mention rules or guidelines for holding a conversation. The third item measures the ability to apply the conversation rules when engaging in a 2-minute conversation.

Assessment of this skill involved: Children were asked to introduce themselves. Each bit of information such as a name, age, date-month, and year of birth was awarded 1 point (max 4). For the second item, the child was asked to mention conversation rules. Each rule that was mentioned yielded 1 point (max 4). To assess the third item, the experimenter talked with the child for two minutes. The assessor would record when the child followed used any of four pre-defined conversation rules (i.e., maintains eye contact, waits for his/her turn to speak, asks and responds correctly, and stays on topic). Each rule that was followed yielded 1 point (max 4).

The Early Digital Literacy test was a modified version of the test used in the previous study (Maureen et al. 2018). For cognitive skills assessment, the item

predicting an event replaced recalling an event. For social–emotional skills assessment, the item involving stating conversation rules was added. The previous study found satisfactory reliability for pretest ($\alpha = 0.65$) and posttest ($\alpha = 0.87$). In the present study, the Early Digital Literacy test was also administered before and after the intervention. Reliability analyses using Cronbach's alpha showed that the pretest was not reliable. This was presumed to be an effect of the novel nature of the items for the children. The intervention should help in this respect, and it did. There was a high reliability score on the posttest ($\alpha = 0.84$).

Procedure

The study consisted of three phases: pretest (Weeks 1–2), intervention (Week 3–8), and posttest (Weeks 9–11). In the pretest and posttest phases, a group of three to five children were brought into the reading room of the school where the experimenter and two research assistants were present. The experimenter and one research assistant would then assess each child individually. Administration of the Early Literacy test took 10-15 min for each child. The Early Digital Literacy test took 25-35 min per child. While testing was being done, the other children in the room engaged in play activities led by the second research assistant.

During the intervention phase, children in the control condition engaged in their regular, weekly literacy-oriented activities led by their classroom teacher with the experimenter present. The children in the two experimental conditions received one unit of storytelling activities or digital storytelling activities each week for a total of six weeks. These sessions were led by the experimenter with the teacher present.

Data Analysis

The data from 9 (out of 62) children were removed from the data analysis. Seven children were removed because they had participated in fewer than five sessions of the storytelling units. Two other children were not able to complete all the tests. The dataset for the analyses comprised 53 children (16 in Control condition, 21 in the Storytelling condition, and 16 in the Digital Storytelling condition).

Tests on assumptions of normality of distribution and homogeneity of variance revealed violations for the Early Literacy test. For scores from this assessment, we therefore, report findings from nonparametric tests (i.e., the Kruskal–Wallis H test) followed by post hoc tests (i.e., the Mann–Whitney U test). For scores from the Early Digital literacy test regular parametric tests (ANOVA) could be employed, followed by a Tukey HSD post hoc test. Testing was one-tailed for predicted improved effects in the intervention conditions, or otherwise was two-tailed, and Alpha was set at 0.05. For effect size, we report the r statistic (Cohen 1988) and r effects was classified as small (0.10–0.29), intermediate (0.30–0.49), and large (0.50—higher).

Results

In this section, findings are reported for the two research questions: (1) "How does early literacy development in the two storytelling conditions compare with such development for the control condition?". (2) "How does early digital literacy development in the two storytelling conditions compare with such development for the control condition?". It was predicted that children in the Storytelling condition and the Digital story telling conditions would have stronger scores on the Early Literacy measures than children in the Control condition. And that children in the Digital storytelling condition would have the strongest scores for measures of Early Digital literacy, followed by the Storytelling and Control conditions.

Early Literacy Skills

The findings for the Early Literacy Skills assessment at pretest and posttest are presented in Table 2. Mean scores of the participants in all three conditions were below the mid-scale value of 2 on the pretest. On the posttest, these scores for all three groups had improved, resulting in mean scores well above the mid-scale value of 2. In addition, level of variability of children's posttest scores in each condition had reduced, as indicated by the standard deviations.

Scores for the Early Literacy pretest did not differ between conditions, $H(53) = 0.0168$, $p = 0.558$. However, there was a statistically significant difference on the Early Literacy posttest, $H(53) = 8.739$, $p = 0.013$. Post hoc tests showed a statistically significant and large difference in the comparison of scores between Control and Storytelling condition, $U(37) = 66.50$, $z = 1.804$, $p = 0.0365$ (one-sided), $r = 0.51$. In addition, there was a statistically significant and large difference in the comparison between the Control and Digital Storytelling condition, $U(32) = 203.50$, $z = 2.863$, $p = 0.0015$ (one-sided), $r = 0.50$. There was no difference between the Storytelling and Digital Storytelling condition, $U(37) = 215.00$, $z = 1.449$, $p = 0.156$.

The boxplots for the Early Literacy assessment, pretest and posttest (Fig. 1) further detail the learning development for each condition. The tinted areas in each box represent the middle 50% of the scores. The slightly thicker horizontal line in the box is the median. The top (or bottom) 25% of the scores are shown in the distance between the highest (or lowest) horizontal line and the highest (or lowest) edge of the tinted box. For the pretest scores, all tinted boxes overlap. For the posttest

Table 2 Means (standard deviation) for early literacy skills tests by conditions

Condition	Pretest		Posttest	
	Mean	(*SD*)	Mean	(*SD*)
Control ($n = 16$)	1.56	(0.78)	2.85	(0.42)
Storytelling ($n = 21$)	1.44	(0.95)	3.08	(0.85)
Digital storytelling ($n = 16$)	1.57	(1.00)	3.43	(0.58)
Total ($n = 53$)	1.51	(0.90)	3.12	(0.69)

Scored on a 0–4 point scale, 4 is the highest score

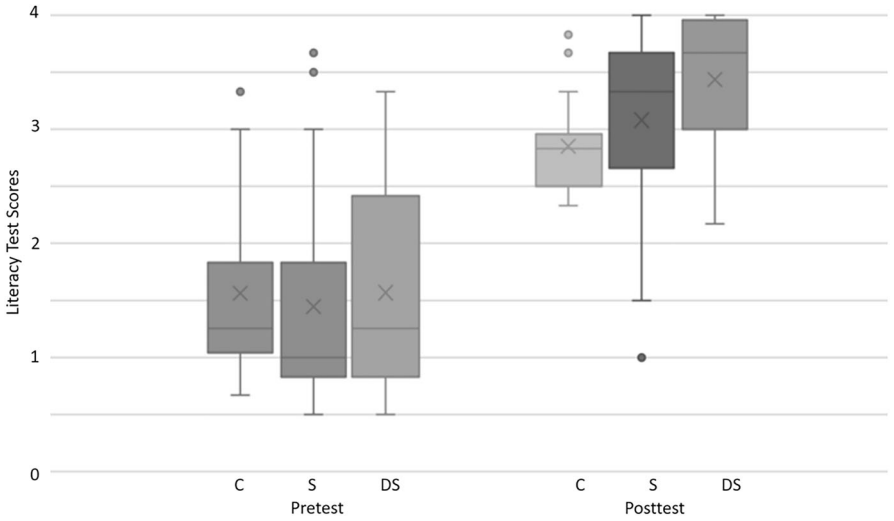

Fig. 1 Boxplots (with × indicating the *Mean*) of the Early Literacy pretest and posttest scores by Condition (*C* control; *S* storytelling; *CS* digital storytelling)

scores, only the tinted boxes of the Control and Digital Storytelling condition do not overlap. There is some overlap between the Control and Storytelling conditions and between the Storytelling and Digital Storytelling conditions.

Early Digital Literacy Skills

Table 3 shows findings of the pretest and posttest scores for Early Digital Literacy development. The results showed that the pretest scores in all three conditions were well below the mid-scale value of 2. The mean posttest score was well above the mid-scale value. The variances, indicated by the standard deviations, were relatively low for pretests and posttests.

ANOVA showed that there were no statistically significant differences between conditions on the Early Digital Literacy pretest, $F(2,50) = 1.008$, $p = 0.372$. In contrast, a statistically significant difference was found on the posttest, $F(2,50) = 11.479$, $p = 0.00$. Post hoc tests showed that there was a statistically

Table 3 Means (standard deviation) for the early digital literacy skills tests by condition

Condition	Pretest		Posttest	
	Mean	(*SD*)	Mean	(*SD*)
Control ($n = 16$)	1.49	(0.24)	2.34	(0.32)
Storytelling ($n = 21$)	1.60	(0.28)	2.92	(0.56)
Digital storytelling ($n = 16$)	1.52	(0.21)	3.04	(0.36)
Total ($n = 53$)	1.54	(0.25)	2.78	(0.53)

Scored on a 0–4 point scale, 4 is the highest score

significant, and large, difference for the comparison between the Control and Storytelling condition, $p = 0.001$, $r = 0.66$; and also for the comparison between the Control and Digital Storytelling condition, $p < 0.001$, $r = 0.82$. The two experimental conditions did not differ significantly from each other, $p = 0.693$.

The boxplots for the Early Digital Literacy pretest and posttest (as shown in Fig. 2) further detail the comparison between the conditions. For the pretest scores, the tinted boxes of the three conditions overlap each other. For the posttest scores, the tinted box of the Control condition does not overlap with those of the Storytelling or Digital Storytelling condition. In contrast, there is overlap between experimental conditions and the median scores of these conditions are similar.

Discussion

In this research, the processes of storytelling were blended with Gagné's nine events of instruction (Smith and Ragan 2005) in delivery of play-based activities to support early literacy and early digital literacy. Storytelling has long been related to literacy development. In this intervention, events were structured for learning through specific design of teachers' and children's activities. Embedding storytelling in activities (re)introduces natural forms of instruction for early childhood education. The study investigated whether these approaches could effectively support change in early literacy and early digital literacy learning outcomes.

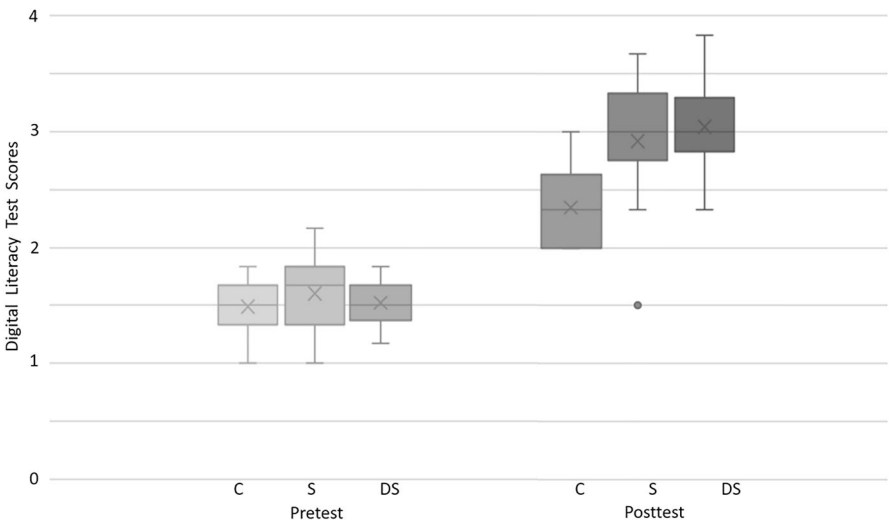

Fig. 2 Boxplots (with × indicating the *Mean*) of the Early Digital Literacy pretest and posttest scores by Conditions (*C* control; *S* storytelling; *CS* digital storytelling)

Storytelling Activities for Literacy Development

The present study found stronger literacy development for the two experimental conditions compared with the control group. The difference was statistically significant and the effect size showed strong change. This finding replicates the outcome of a previous study with a shorter intervention period (Maureen et al. 2018). The finding supports the choice for a design approach that revolves around storytelling in which explicit instructions and opportunities for practice are interleaved.

The storytelling session presented the teacher with explicit instructions to introduce the children to the code-based characteristics of written language (Zubrick et al. 2015) and to provide repetition and context to enhance words comprehension (Wright and Neuman 2014). These were complemented with opportunities for practice in the chosen follow-up activities in which the children actively explored the related letters, words, and sounds. The coupling fits recommendations for high quality literacy instruction (Justice et al. 2008). In addition, it concurs with the view that literacy development is driven by meaning-making (Tolentino and Lawson 2017).

Though there were no significant differences between the experimental conditions. The digital storytelling condition showed slightly stronger gains compared to the storytelling condition. This can perhaps be explained by the fact that the use of digital elements can contribute to making abstract content more understandable and motivating for young children (e.g., Boerma et al. 2016).

Storytelling Activities for Digital Literacy Development

The study found stronger digital literacy development in the experimental conditions than in the control condition. As for literacy development, the difference was statistically significant. The finding substantiated the tentative outcome that was reported in an earlier study (Maureen et al. 2018). No difference was found between the two experimental conditions.

The absence of a difference between the two experimental conditions may be due to the comparable activities across these conditions. An important and shared foundation in both approaches is the presence of follow-up activities that stimulated the children to develop their understanding of stories (González 2010). These play-based activities were incorporated within the broader framework of a storytelling approach. Through participation in storytelling experiences, in this case, by listening to a story and discussing about it afterward, children could acquire a sense of story, about how it begins and ends, and how the social element of language enables stories to evolve. These activities support the children in constructing a story model or schema that affords them with opportunities to explain certain events in a story and make predictions of events that may come to pass.

Limitations and Future Research

The present study offers some insight into the instructional design and the measurement of a broad spectrum of literacy skills in early childhood education. These research findings would benefit from further research into the use of these self-developed measurement instruments to establish validity with other available standardized tests of literacy.

The study was also limited by the fact that the storytelling activities were led by the experimenter while regular activities in the control condition were taught by the classroom teacher. During the activities, the teacher or experimenter served as a teaching assistant or vice versa. This choice was based on the view that the regular program in the control condition should be as realistic as possible.

Conclusions

We consider that effective storytelling hinges on five key features of stories (i.e., setting, theme, characters, plot, and conflict) from which children acquire a story schema that supports later reading comprehension. While effective digital storytelling also requires attention to personalization, a specific point of view, a dramatic question, emotional content to personalize the content, power of voice, a soundtrack, economy of presentation, and pacing (Robin 2008). When these ideas were applied in the design of the units for this intervention, they were not tested separately or against each other. This challenge can be taken up in future studies, as is the suggestion that child variations in motivation and engagement with digital and traditional storytelling may also be important factors to consider.

Overall, the present study has provided empirical evidence that a framework in which a blend of structured instruction with storytelling and play-based activities, both in oral and digital forms, can effectively support children's literacy and digital literacy development.

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study has been approved by the Ethical Committee of University of Twente.

Informed Consent Informed consent was obtained from the parents/guardians of all individual participants included in the study.

Appendix 1

Scoring rubric for Early Literacy Assessment

	Key Skill	Description	0 Point	1 Point	2 Points	3 Points	4 Points
1	Name writing	Write first name (/ nick name)	Needs help to write first name	Writes first name with a model with some errors	Writes correctly first name with a model	Writes first name correctly without a model	Writes first name correctly without a model, capitalizing first letter
2	Alphabet knowledge (1)	Recognize capital letters	Needs help to recognize any letters	1–5 Letters recognized	6–15 Letters recognized	16–25 Letters recognized	26 Letters recognized
3	Alphabet knowledge (2)	Recognize lowercase letters	Needs help to recognize any letters	1–5 Letters recognized	6–15 letters recognized	16–25 letters recognized	26 Letters recognized
4	Phonological awareness	Identify the initial sound of words	Needs help to identify the initial sound of a word	1–6 Words identified	7–12 Words identified	13–18 words identified	19 Words identified
5	Print awareness (1)	Recognize names in written form	Needs help to recognize any friend's name on the children's attendance list	1 name recognized	2–3 Names recognized	4–5 Names recognized	6 Names recognized
6	Print awareness (2)	Recognize daily words	Needs help to recognize any word	1–5 Words recognized	6–12 Words recognized	13–19 Words recognized	20 Words recognized

Appendix 2

Scoring rubric for Early Digital Literacy Assessment

#	Skill	Description	0 point	1 Point	2 Points	3 Points	4 Points
1	Cognitive (1)	Plan an event	No response given	Contains information about: what	Contains information about: what and where/ when/who	Contains information about: what, who, where, when (3 or 4)	Contains information about: what, who, where, when, how, why
2	Cognitive (2)	Read a picture	Needs help to mention anything seen in a picture	Mentions 1-2 things seen from picture(s) with clues	Mentions 1–2 things seen in picture with clues Infers story of a picture	Mentions 3-4 things seen from 2 pictures Infers the story of 2 pictures	Mentions 3-4 things seen from 3 pictures Infers the story of 3 pictures
3	Cognitive (3)	Predict an event	Makes an off-topic prediction or gives no response	Makes prediction of logical sequence of picture, given details or clues	Makes prediction of logical sequence of picture	Makes prediction of logical sequence of 2 pictures	Makes prediction of logical sequence of 3 pictures
4	Social–emotional (1)	Recognize own identity	Needs help to mention own full name	Mentions own full name	Mentions Own full name Own age	Mentions Own full name clearly Own age Own birthday (d-m-y)	Mentions Own full name clearly Own age Own birthday (d-m-y)
5	Social–emotional (2)	Mention conversation rules	Gives no response	Mentions 1 conversation rule	Mentions 2 conversation rules	Mentions 3 conversation rules	Mentions 4 conversation rules

#	Skill	Description	0 point	1 Point	2 Points	3 Points	4 Points
6	Social–emotional (3)	Engage in a conversation	Passively responds to questions	Needs reminders to follow all rules of conversation	Needs reminders to follow some of rules of conversation	Needs reminders to follow a few rules of conversation	Follows all rules of conversation: Maintains eye contact Waits for his/her turn to speak Asks correctly (stays in topic) Responds correctly (stays in topic)

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