Contributions of the Home Literacy Environment and Underlying Language Skills to Preschool Invented Writing

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Abstract

This study aimed to enhance our knowledge of the constituent variables affecting invented writing skills in five-year-olds by investigating the concurrent relationships among home literacy, underlying language skills, and invented writing. The study comprised 111 Norwegian-speaking children (mean age: 5.7 years; 58 girls) and their parents. The children's language skills were tested individually. The results showed that, on average, children achieved low scores on tests of word writing; however, the within-group variations in the children's invented writing performances were large. The statistical modelling showed that parental education was significantly related to the home literacy environment, which was, in turn, directly related to both vocabulary and phonological awareness and indirectly related to invented writing skills. Implications of the findings are discussed.

Keywords. Invented writing, preschool, home literacy, early literacy

Introduction

Over the last several decades, research has broadly investigated the precursors of literacy in preschool children (Bryant, MacLean, Bradley, & Crossland, 1990; de Jong & van der Leij, 1999; Elbro, 1996; Lundberg, Frost, & Petersen, 1988; Muter, Hulme, Snowling, & Stevenson, 2004; National Early Literacy Panel [NELP], 2008; Tabors, Snow, & Dickinson, 2001; Whitehurst & Lonigan, 1998, 2002). This has led to an increased understanding of the importance of the preschool years in children's literacy development. However, most studies have investigated the precursors of *reading* skills; relatively little attention has been devoted to the skills that underpin *writing* (Joshi & Aaron, 2005; for some exceptions, see Dyson, 2013; Ouellette & Sénéchal, 2008b; Treiman & Bourassa, 2000). Around the age of five to six years, prior to formal reading and writing instruction in school, many children in literate societies take an interest in writing, often through spontaneous, invented (or inventive) writing (Clarke, 1988; Clay, 1975; Hagtvet, 2010; Read, 1971). This preschool writing activity appears to be a powerful gateway to literacy for those children who use it.

Our study focuses on preschool emergent writing skills and other aptitudes that support these skills, such as oral language and script knowledge. Research has shown that these skills underpin later reading and writing skills as more formally taught in school (Whitehurst & Lonigan, 1998). A further focus is the bearing that the home environment has on these emergent preschool literacy skills. Several studies have documented that emergent literacy skills develop interdependently with literacy experiences and interactions in the home (Burgess, Hecht, & Lonigan, 2002; Sénéchal & LeFevre, 2002; Whitehurst & Lonigan, 1998). Parental encouragement, instruction, and guided participation are important components of these interactions, as are home literacy activities that more implicitly affect and support literacy development (e.g., the parents' own reading and the amount and types of words heard at home) (Levin & Aram, 2012; Sénéchal & LeFevre, 2002, 2014). For applied and

theoretical reasons, it is important to understand how the home literacy environment relates to a child's invented writing and how the two are related to other concurrently developing emergent literacy skills. The purpose of the current study was to expand our understanding of these relations by investigating their concurrent relationship in five-year-old children attending their last term in preschool. We approached the study with the following research question: How are parental education, home literacy, vocabulary, phonological awareness and letter knowledge related to five-year-olds' invented writing skills?

Invented Writing—A Gateway to Literacy

A child's first writing attempts are often referred to as *invented writing* (Puranik & Lonigan, 2011; Teale & Sulzby, 1986; Whitehurst & Lonigan, 1998) or *invented spelling* (Read, 1971). These attempts refer to a child's pre-alphabetic and early alphabetic writing pursuits, such as scribbling, pretend writing, or explorations of the spelling system through creative use of the limited letters the child knows (e.g., writing *bt* or *bet* for *beat*) (Treiman, 1998). To many preschool children, this is a powerful gateway to literacy.

Most of the existing research on invented writing is descriptive and developmental (Clark, 1988; Clay, 1975; Read, 1971). Only recently has invented writing been investigated in intervention research with preschool children (Hofslundsengen, Hagtvet, & Gustafsson, 2016; Levin & Aram, 2013; Martins, Albuquerque, Salvador, & Silva, 2013; Martins, Salvador, Albuquerque, & Silva, 2014; Ouellette & Sénéchal, 2008a; Ouellette, Sénéchal, & Haley, 2013; Rieben, Ntamakiliro, Gonthier, & Fayol, 2005; Sénéchal, Ouellette, Pagan, & Lever, 2012). The results of these studies show that practicing invented writing has a positive effect not only on children's writing development, but also on their reading development (Hofslundsengen, Hagtvet, & Gustafsson, 2016; Martins et al., 2013, 2014). However, the competencies and skills that constitute children's early writing have received little attention.

Writing is often treated as a corollary of reading; however, even though the two skills are highly related, they are not identical (Ehri, 2000). Still, the sub-skills involved, such as letter knowledge, phonological awareness, and vocabulary, likely act as common building blocks (NELP, 2008; Tolchinsky, 2004). Invented writing and beginning reading are, therefore, presumably strongly connected; in most cases, they develop in reciprocity (Ehri, 2014). Nevertheless, our understanding of *how* these building blocks contribute to invented writing and how they are interrelated is rather shallow, in particular in orthographies other than English. The current study applies the semi-transparent Norwegian orthography and a preschool sample of mainly non-reading five-year-olds to advance our understanding of these interrelations.

Home Literacy Environment and Parental Education

The home literacy environments that parents provide for their children are likely the most important contributors to preschoolers' literacy learning (Burgess et al., 2002; Manolitsis, Georgiou, & Tziraki, 2013; Niklas & Schneider, 2013). The home literacy environment includes both what parents do as role models (passive/implicit impact) and the literacy activities they do with their children (active/explicit impact) (Burgess et al., 2002). What parents do as role models at home presumably depends on their own experiences with and interests in reading and writing activities). These experiences and interests, in turn, typically reflect parental education (Davis-Kean, 2005; Evans, Shaw, & Bell, 2000; Hemmerechts, Agirdag, & Kavadias, 2017), which is often seen as a marker of the quality of a home literacy environment. It is also and a powerful factor in children's socialization processes: through modelling, parental involvement in literacy activities slowly becomes a part of their children's habitus (Bourdieu & Passeron, 2006). However, this process is not well understood, presumably because it is not parental education per se, but *how* parental

education is transformed into home literacy activity that matters (Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004; Sylva et al., 2011).

One common home literacy activity is shared book reading (Burgess et al, 2002; Niklas & Schneider, 2008). Through book reading, a child's learning commonly comes about not through direct instruction, but through interaction with an adult who comments on or asks questions about a text (Sénéchal & LeFevre, 2002; Sénéchal, LeFevre, Thomas & Daley, 1998). Research shows that shared book reading is positively related to a child's vocabulary level (Deckner, Adamson, & Bakeman, 2006; Hood, Conlon, & Andrews, 2008; Niklas & Schneider, 2013; Sénéchal & LeFevre, 2014; Silinskas et al., 2012). The effects of shared book reading on print knowledge, however, are more unclear. In a meta-analysis, Mol and Bus (2011) found a moderate correlation between adult–child shared reading and children's knowledge of the alphabet and orthographic processing (i.e., the children's ability to identify frequently occurring parts in written words). However, in an intervention study of the effects of shared book reading on code-related skills including preschool children at age four, significant effects on print knowledge were obtained only when the adult explicitly referred to the text during the reading (Justice et al., 2009). Taken together, these studies suggest that parent–child book reading positively affects a child's vocabulary development, while print knowledge and awareness of the alphabetic code is best facilitated when the child's attention is directed explicitly to the script.

The Importance of Oral Language and Script-Related Skills for Invented Writing

The relationship between invented writing and other early literacy skills may in simple terms be described as a product of encoding and linguistic comprehension (i.e., writing = encoding x linguistic comprehension; Hagtvet, 2010). This simple view highlights two major components of the writing process: the ability to *encode* via a script (e.g., the alphabetic code) and the ability to *produce* a meaningful verbal message. Typically, when young children

write, they explore sound–letter patterns in a multisensory way to express their messages (e.g., by sight, listening to the sounds, articulation, and even kinesthetic experiences). They draw upon their vocabulary knowledge, print awareness, and phonological skills at an advanced metacognitive level, while simultaneously transforming ideas into appropriate words and sentences. This process typically involves focused attention, ego involvement, and motivation.

Phonological awareness has been found to be strongly correlated with invented writing (McBride-Chang, 1998), and phonological awareness training has also led to improvements in children's writing aptitudes (Ehri et al., 2001; Tangel & Blachman, 1992). Intervention studies have confirmed the positive relation between phonological awareness and writing skills and shown that the practicing of invented writing in preschool children aged five supports the development of phonological awareness (Martins & Silva, 2006; Ouellette & Sénéchal, 2008a; Sénéchal et al., 2013). Together, these studies suggest a reciprocal relationship between invented writing and phonological awareness, particularly in connection with the encoding of sounds and letters into single words, and in deep orthographies.

The few studies that have investigated the relationship between vocabulary and early writing skills indicate that the two are moderately correlated (Al Otaiba et al., 2010; Kim, Al Otaiba, Puranik, & Folsom, 2011; Kim et al., 2014; Ouellette & Sénéchal, 2008b). Arguably, this correlation varies with the semantic load of the text.

Taken together, these findings confirm that the process of encoding sounds to their letter equivalents during invented writing draws heavily on phonological skills, but less so on semantic knowledge, presumably because invented writing typically involves well-known words and simple messages.

Letter knowledge (i.e., knowledge of a letter's graphic form, sound, and name) is another foundational skill of writing. Studies have documented a positive relation between

letter knowledge and invented writing (Al Otaiba et al., 2010; Kim et al., 2014; Ouellette & Sénéchal, 2008b); during invented writing, children try to map the sounds they are able to distinguish in their speech to the graphical representations they know. In so doing, children often spell words by their letter names instead of by their sounds: for example, *plo* for *pillow* (Treiman & Kessler, 2014) or *rudf* for *are you deaf* (Gentry, 1982). Some children may know the letters' names, yet be unable to match them to their relevant phonemes when writing words; they know the letter names formally, but not functionally, that is, they do not know how to use the letters to form meaningful words or messages (Frost, 2001).

The Current Study

We sought to investigate the concurrent relations among parental education, children's home literacy environment, and five-year-olds' emerging literacy skills, with a specific focus on invented writing. Numerous studies have previously investigated the language variables that underpin reading skills, but few have included the impact of home literacy, and even fewer have studied these variables in relation to invented writing skills. A questionnaire on parental education level and the home literacy environment was distributed to the parents, and the children's language and literacy skills were assessed individually using a test battery. The concurrent relationships among the variables were evaluated via structural equation modeling.

Our study delved beyond existing studies by addressing these issues with reference to the Norwegian semi-transparent orthography where most words are spelled regularly (Hagtvet, Helland, & Lyster, 2006; Furnes & Samuelsson, 2011). Exceptions include, for example, words written with double consonants after a vowel pronounced with a short tone (e.g., *gull* [gold] versus *gul* [yellow]) and complex orthographic units, such as representations of one phoneme with two or three letters (e.g., *skj* for / ʃ /, as in shirt). A number of studies indicate that learning to write alphabetically is easier in a fairly transparent orthography than in a more opaque orthography, such as English (Seymour, Aro, & Erskine, 2003).

A further expansion of previous research regards the Norwegian social and educational context. Norwegian preschools are financed largely by the government, and 97% of five-year-olds attend preschool seven to eight hours each day (Statistics Norway, 2017). The preschool level is considered the first step in the state-governed educational ladder, and all preschools follow a national curriculum (Norwegian Ministry of Education and Research, 2017). Their approach is mainly social pedagogical, with a curriculum focus on oral language learning (e.g., oral language interactions, symbolic play, and storybook reading). The attention paid to formal or informal instruction in reading or writing is generally limited, as is the focus on letter knowledge (Norwegian Ministry of Education and Research, 2017). Formal literacy learning begins at the age of six in the first grade of primary school, but goals for skills in reading and spelling are not specified until the end of Grade 2. We therefore expect the home literacy environment to be an important arena for early literacy learning, regardless of preschool attendance.

We used latent modeling techniques, such as confirmatory factor analysis and structural equation modeling, to investigate the concurrent relationships among the variables. By using latent variables with several indicators, we reduced the effects of measurement errors and achieved more reliable representations of the nature of the relationships. Based on the theoretical assumptions previously reviewed, the latent modeling was carried out in two steps to achieve a more functional understanding of the relationships among the variables. In step one, we explored the relationship between the home environment and the language skills underpinning invented writing. We expected parental education to affect the home literacy environment (Davis-Kean, 2005) and anticipated positive relationships between home literacy and vocabulary (Hood et al., 2008), phonological awareness (Niklas & Schneider, 2013), and letter knowledge (Burgess et al., 2002; Mol & Bus, 2011; Niklas & Schneider, 2008). In step two, we included invented writing in the model. Based on research showing that home

literacy modestly affects script-related skills, we predicted a positive and significant relationship between home literacy and invented writing (Mol & Bus, 2011). Furthermore, we hypothesized positive relationships between vocabulary knowledge and invented writing, based on similar findings among English-speaking children in previous work (Kim et al., 2011, 2014). Finally, we anticipated a strong relationship between letter knowledge, phonological awareness and invented writing (Martins et al., 2013; McBride-Chang, 1998; Ouellette & Sénéchal, 2008a; Ouellette, Sénéchal, & Haley, 2013).

Method

The sample

The sample comprised 111 Norwegian-speaking preschool children (mean age: 5.7 years, 58 girls and 53 boys) recruited from 12 preschools in a combined urban and rural area in Western Norway. A total of 11 children spoke a first language other than Norwegian (e.g., Dutch, Polish, Romanian, and Somali) at home. All five-year-old children in the 12 preschools were invited to participate, and the participating children constituted 80% of those invited. The preschools served families of diverse socio-economic backgrounds (SES), operationalized as parental education. Only 4% of the parents left school after lower secondary school, and 40% reported an educational level terminating at upper secondary school with professions such as carpenter, painter, nursing assistant, farmer, or chef. Over half of the parents (53%) reported college/university education, implying professions such as teacher, nurse, doctor, or office worker. The national percentage of individuals between 30 and 39 years with a university education was 48% (Statistics Norway, 2015), suggesting that our parents' education level was somewhat above the national average. The majority of the children (87%), which was higher than the national average of 76%, lived with both parents (Statistics Norway, 2016).

Procedure and Materials

A series of tests were employed to assess the children's language skills. The children were tested individually by trained research personnel in a quiet area of the preschool. The entire testing session lasted approximately 30 minutes. Questionnaires were distributed to parents by the preschool teachers and then completed by the parents.

Measures

Home literacy environment. Home literacy was assessed with three questionnaire items that focused on both "parental reading" (the passive environment (i.e., mothers' and fathers' reading habits) and "parent-child-reading (the active environment, i.e., average time devoted to reading with their children):

- "How much time do you set aside for yourself to read each week in a book or newspaper?" (mothers)
- "How much time do you set aside for yourself to read each week in a book or newspaper?" (fathers)
- "How much time do you devote to shared book reading with your child per week?"

A six-point scale quantified the level of reading (no reading = 0; 30 minutes = 1; 45 minutes = 2; 60 minutes = 3; 90 minutes = 4; more than 90 minutes = 5). Each parent was rated separately.

Parental education. Parental education was determined by asking both parents to mark their highest level of completed education on a five-point scale (other/no education = 0; lower secondary school, a total of nine years = 1; upper secondary school = 2; bachelor's degree = 3; and master's degree [the highest level of attainment] = 4).

Receptive vocabulary. Vocabulary was assessed using the Norwegian edition of the British Picture Vocabulary Scale II (BPVS; Dunn, Dunn, Whetton, & Burley, 1997). The children were asked to select one out of a set of four pictures that best illustrated the meaning

of a target word, which was presented orally. The target words represented a range of content areas with increasing difficulty. The test items were randomly divided into two groups (odd or even numbers) to support the estimation of a latent variable in the analysis (max score: 72).

Phonological awareness. Phonological awareness was measured using four tests. First, the children's capacity to rhyme and match the final sounds of words was evaluated (max score: 16; Furnes & Samuelsson, 2009). In this test, the children were shown four pictures alongside an orally presented target word and asked which word rhymed with the target word (e.g., *hus* [house] rhymes with *mus* [mouse] and not with *bil* [car] or *frosk* [frog]). Three sub-tests from the Comprehensive Test of Phonological Processing (CTOPP; Wagner, Torgersen, & Rashotte, 1999; Norwegian edition: Furnes & Samuelsson, 2009) were utilized (sound matching, elision, and blending words, each with a max score of 20). During the sound matching task, the target word and three alternative words were presented both orally and through pictures. The children were told to indicate which picture started or ended with the same sound as the target word. For the blending task, the children listened to a series by phonemes and were then asked to identify the intended word. Lastly, the elision task required the children to repeat a word and then omit a syllable or phoneme (e.g., to say *gris* [pig]) without saying /g/).

Letter knowledge. The children were shown 24 capital letters (excluding C, X, Z, Q, and W, but including Norwegian letters *Æ*, *Ø*, and Å) in a fixed random order and asked to provide the phonemes or letter names associated with each. Every correct answer accounted for one point (max score: 24).

Reading. First, to investigate whether a child was able to read at all, we showed each child a few logos (e.g., LEGO and ESSO [a gas station]). If a child made no use of an alphabetic reading strategy, the task was repeated with visual support (e.g. a picture of a gas station in combination with ESSO) and the word could be read logographically. The purpose

of this approach was mainly to prevent the child with no alphabetic reading skill from feeling inferior, and no further reading assessments were carried out. However, if the child tried to read alphabetically, the level of alphabetic reading skills was assessed using the Norwegian edition of the Test of Word Reading Efficiency (TOWRE; Torgesen, Wagner, & Rashotte, 1999), which included both real words and non-words. The child was asked to read as many words as possible within 45 seconds per list. The lists began with two-letter words and progressed in difficulty. The final score represented the number of words read correctly within the allotted time. The reading test was only included in the descriptive analysis.

Writing dictated single words. This writing task takes developmental phonological plausibility into account, which is a frequently used procedure in scoring invented writing (see Byrne & Fielding-Barnsley, 1993; Furnes & Samuelsson, 2009; Kim et al., 2011, 2014). In our application, the task comprised two parts. Each child was first asked to write 10 regularly spelled words (e.g., *lampe* [lamp] & *melk* [milk]) and then asked to write four non-words (e.g., *ig*, *sut*) (Byrne & Fielding-Barnsley, 1993; Norwegian adaption: Furnes & Samuelsson, 2009). If a child did not write, he or she was encouraged to pretend write or draw. Each word was scored on a scale ranging from zero to six points using the following criteria (max score: 84; Byrne & Fielding-Barnsley, 1993):

- no writing attempt or an attempt that resulted in an incorrect letter (score = 0);
- one letter associated with a letter from the target word (i.e., n for *melk* [milk] = 1);
- one correct letter from the target word (i.e., m = 2);
- at least two correct phonemes represented with letters (i.e., me = 3);
- all phonemes represented with letters, but incorrectly (i.e., mejg = 4);
- all phonemes from the target word represented with letters, but one confused with an articulatory related, yet orthographically incorrect letter (i.e., melg = 5);
- entire word was orthographically correct (i.e., melk = 6).

Using this scoring system, a child received credit not solely for correct answers, but also for attempting to write; therefore, the system reflected children's typical writing development during preschool and early elementary school.

Writing a dictated sentence. In this task, the children were asked to write their first name followed by the two words, *liker* and *is* on a sheet of paper (e.g., *Thomas liker is* [Thomas likes ice cream]). If a child indicated that he or she did not know how to write, he or she was encouraged to pretend write or draw. The child's written product (not including the name) was scored as follows (max score: 5; Child, Language and Learning, 2010): no attempt to write (score = 0); pre-phonemic writing (i.e., scribbling = 1); semi-phonemic writing (less than 25% of letter–sound connections are correct; e.g., I for *liker is* = 2); semi-phonemic writing (25–75% of letter–sound connections are correct; e.g., IS for *liker is* = 3); phonemic writing (75% of letter–sound connections are correct; e.g., LIKR IS for *liker is* = 4); orthographically correct sentence (score = 5).

Data Analysis Strategies

The data were analyzed using Mplus version 7.2 (Muthén & Muthén, 2013) and structural equation modeling (SEM) to assess the structural relationships amongst the latent variables. Latent variable models support the estimation of error variance in observed variables, which helps to minimize bias in the analyses (Kline, 2011). We assessed the fit of the models to the data based on the chi-square test statistic. Furthermore, goodness of fit indices, such as the comparative fit index (CFI) and the root mean square error of approximation (RMSEA), provided information about the amount of deviation between the hypothesized model and our observed data. To compare the models, we also relied on the Akaike Information Criterion (AIC). The RMSEA 90% confidence interval (CI) demonstrates its degree of precision. A non-significant p-value, RMSEA values below .08, and a CFI value above 0.95 indicated an acceptable fit (Kline, 2011). Though SEM does not confirm a model to be true, a good fit

indicates that the model is theoretically plausible. Because there were non-normal distributions of certain variables (e.g., excess skewness and kurtosis) in the analysis, the maximum likelihood estimator with robust standard errors (MLR) was utilized. To investigate the indirect effects, we used bootstrapped asymmetric confidence intervals, which have been found to be more accurate (Kisbu-Sakarya, MacKinnon, & Miočević, 2014).

Results

The descriptive results, including the means, standard deviations, and reliabilities for the measures (see Table 1), were checked before we investigated the relationships among the latent variables. The descriptive analyses showed that the mean word-writing score was well below the maximum score and that the standard deviation was large, suggesting that many children had limited writing skills. In fact, only 35% of the children obtained a score in the invented writing task, while 70% of the children obtained a score in the sentence writing task. Few children were able to read words, and only 18% of the children obtained a score on this task. Reading was therefore only included in the descriptive statistical analysis. The descriptive analysis of the home literacy environment showed that almost all of the children were read to at home and that, on average, these five-year-olds knew between 12 and 13 letters.

[Table 1. here]

The correlations amongst the observed measures are shown in Table 2. The word writing task was significantly correlated ($r > .60$) with letter knowledge, sound matching, and blending. It was also strongly correlated with word reading ($r = .75$). Both word writing and sentence writing were further significantly correlated with vocabulary ($r = .30$ and .26, respectively), but not with parental reading or parental education. Time spent on parent–child book reading was significantly correlated with the mothers' and fathers' reading habits ($r = .52$ and .35, respectively). It was also moderately correlated ($r = .30$) with vocabulary and sound

matching, and slightly (but significantly) correlated with word and sentence writing (r = .19 and .25, respectively). Together, these findings indicate that the children's emergent writing skills were related to the underpinning code-related skills, and that some of the children who wrote had also started to read. They also suggest that parental reading and parent-child reading affected the children's vocabulary and phonological awareness skills, and finally also that shared book reading may stimulate invented writing in certain children in this early phase of development.

[Table 2. here]

Confirmatory Factor Analyses

Next, an oblique confirmatory factor analysis (CFA) was applied to specify the relationships between the observed variables and the six hypothesized latent variables: invented writing, phonological awareness, letter knowledge, vocabulary, home literacy environment, and parental education. *Invented writing* had three indicators (the writing of single words, non-words, and sentences); *phonological awareness* had four (elision, blending, sound matching, and rhyming); *letter knowledge* had two (vowels and consonants); *vocabulary* had two (odd and even); *home literacy environment* had three (the length of time a child was involved in shared book reading, the amount of time the father spent on reading, and the amount of time the mother spent on reading); and *parental education* had two (mother's and father's education). The CFA model showed an acceptable fit (χ^2 = 122.81, df = 89, χ^2/df = 1.38, RMSEA = .058, CI_{90} = .03 – .08, CFI = .966, TLI = .954, SRMR = .061). The factor loadings of the items ranged from .45 to 1.00 (see Table 3). Overall, the factor loadings were decent, suggesting that the observed variables shared common variance with the latent variables. The lowest factor loadings were from the phonological awareness latent variable to rhyme (.45) and elision (.45); however, both were still significant.

[Table 3. here]

The correlations were significant among the latent variables for invented writing, phonological awareness, letter knowledge, and vocabulary. The correlations between invented writing and the home literacy environment and between invented writing and parental education were insignificant (see Table 4). Home literacy environment was significantly correlated with parental education, vocabulary, and phonological awareness, while the coefficients regarding script-related skills were non-significant. Taken together, these findings suggest significant relationships among all language variables and between the home literacy environment and the oral language variables, but not with the code related variables.

[Table 4. here]

Structural Equation Modeling

To further address the research question of how parental education, home literacy environment, vocabulary, phonological awareness, and letter knowledge are related to invented writing, we used SEM. We carried out the SEM analysis in two modeling steps. In the first step, we investigated the relationships between home literacy and language skills using the latent variables of parental education, home literacy environment, vocabulary, phonological awareness, and letter knowledge. As previously stated, we expected that parental education would be related to the home literacy environment (Davis-Kean, 2005; Evans et al., 2000; Sénéchal, 2006) and that home literacy would affect vocabulary, phonological awareness, and letter knowledge (Burgess et al., 2002; Manolitsis et al., 2013; Niklas & Schneider, 2013). Hence, in Model I, home literacy was regressed on parental education, whereas vocabulary, letter knowledge, and phonological awareness were regressed on home literacy, with covariances amongst the residuals of vocabulary, phonological awareness, and letter knowledge. Model I exhibited a good fit ($\chi^2 = 67.39$, $df = 58$, $\chi^2/df =$

1.16, RMSEA = .038, CI_{90} = .00 – .07, CFI = .983, TLI = .977, SRMR = .059). Parental education was significantly related to home literacy, and home literacy was significantly related to both phonological awareness and vocabulary. However, home literacy was not significantly related to letter knowledge, even though home literacy environment has been found to be a significant predictor of later letter knowledge in English and German preschool contexts (Burgess et al., 2002; Niklas & Schneider, 2008).

[Figure 1. here]

We included invented writing in the second step of the modeling. Based on research on the developmental relations between phonological and vocabulary skills (Walley et al., 2003), we predicted that phonological awareness was a result of vocabulary growth. We further expected close relationships among invented writing, letter knowledge, and phonological awareness (Ouellette & Sénéchal, 2008b). Model II exhibited an acceptable fit (χ^2 = 134.65, *df* = 98, χ^2/df = 1.37, RMSEA = .058, CI_{90} = .03 – .08, CFI = .963, TLI = .955, SRMR = .074). This model revealed that invented writing and letter knowledge were strongly related to phonological awareness (see Figure 2). However, the anticipated direct relationship from letter knowledge to invented writing was not significant and seemed to be mediated by phonological awareness. Using bootstrap asymmetric confidence intervals, the analysis further revealed that home literacy had small but significant indirect effects on invented writing, mediated via vocabulary and phonological awareness (*r* = .13, CI_{95} = .03 to .22). We also identified that vocabulary knowledge had an indirect moderate effect (*r* = .33, CI_{95} = .19 to .48) on invented writing, which was mediated via phonological awareness[1].

[1] To further investigate the relationships, an alternative Model II was run. In this model, phonological awareness was related to letter knowledge, which, in turn, was related to invented writing. However, this model had a poorer fit than Model II, showing that this alternative model should not be preferred (χ^2 = 178.94, *df* = 99, χ^2/df = 1.81, RMSEA = .085, CI_{90} = .06 – .11, CFI = .920, TLI = .903, SRMR = .092).

Comparing the χ^2 values for Model II and the CFA model using the Satorra-Bentler scaled χ^2 difference test, we found no significant difference between the models ($\Delta\chi^2 = 11.90$, $\Delta df = 9$, $p < .22$). Thus, Model II did not have a significantly poorer fit than the CFA model. Specifically, compared to the CFA model AIC, which had an AIC of 7824.87, the AIC for Model II was 7818.52, suggesting a preference for the more restrictive Model II.

[Figure 2. here]

Discussion

This study investigated the concurrent relationships among parental education, the home literacy environment, underlying language skills, and invented writing in five-year-old Norwegian-speaking children. We observed large variations in the children's invented writing skills and only a relatively small percentage of the children (35%) succeeded in writing one letter correctly during word writing. However, many more children (70%) succeeded in writing word parts by scribbling or idiosyncratically using the letters they knew when encouraged to pretend write during sentence dictation. Also, most children wrote their own names correctly. Therefore, by encouraging the children to pretend write, we revealed the children's developmental levels of invented writing, as well as the broader group variation.

As expected, the first set of results (Model II) showed that parental education was significantly related to the home literacy environment, which, again, was significantly but indirectly related to the development of invented writing. This indirect relation was mediated by vocabulary and phonological awareness. Model II further revealed close relationships among the language- and script-related skills. In these relationships, phonological awareness was playing a key role.

Taken together, these findings shed light on some of the under-researched aspects of the environmental and individual factors that constitute children's invented writing skills at age five. The first set of findings concerns how a child's home literacy environment affects

the oral language- and script-related skills involved in writing and reading. As hypothesized, home literacy was directly related to vocabulary, which, in turn, was related to phonological awareness. These observations may suggest that vocabulary skills boost phonological awareness, as hypothesized by Walley et al. (2003). However, since the variables were measured concurrently, causal conclusions cannot be drawn. Furthermore, the non-significant direct relationship (Figure 1) between home literacy and letter knowledge supports the expectation that if Norwegian parents teach their children letter names at all, they do so to only to a limited degree.

The finding that home literacy had a significant effect on children's literacy skills is, by itself, old news. The importance of this finding must be evaluated in relation to the egalitarian structure of the Norwegian social and educational context. In general, the children in the current study had parents with moderate to high levels of education. Most studies highlighting the importance of home literacy for children's language development have examined children from a broader range of social backgrounds, including many children from low socio-economic backgrounds (e.g., Evans et al., 2000; Niklas & Schneider, 2013). The fact that our results corroborate these international data, despite a much lower spread in social-economic background, speaks to the robustness of the observed relations. Given a limited focus on letter naming and children's writing and reading at home, one speculative, yet probable, hypothesis is that the few children who developed skills in invented writing and reading benefitted from a fortunate combination of a supportive home literacy environment (e.g., older siblings) and other facilitating factors, such as individual motivation, cognitive skills, and possibly the semi-transparency of Norwegian orthography. Being an emergent literacy context of great importance (Cochran-Smith, 1984; Sylva et al., 2011), we would, of course, also expect preschool education to play an important role in this development. This is an under-researched area, and more research about the relationships between language and

literacy stimulation in preschool and home is needed, in particular with reference to observational studies within a Nordic context.

The second set of findings concerns the hypothesized direct relationships between phonological awareness and invented writing and how these variables relate to letter knowledge. In Model II (Figure 2), phonological awareness stood out as a core developmental skill during the period in the children's lives when the majority begin to break the alphabetic code. Through its strong relations to both invented writing and letter knowledge, phonological awareness emerges as a primary developmental driver of both invented writing and letter knowledge. In order to explore alphabetic writing, a child depends on both letter knowledge and skills in manipulating words' phonological structures; formal letter knowledge is not, by itself, sufficient to begin writing. Rather, a child must understand why and how the letters are used, and phonological awareness appears to be the insight that facilitates this functionality of the letter (Frost, 2001). In the current sample, only a minority of the children wrote alphabetically. This presumably explains why the alternative Model II, in which phonological awareness was related to letter knowledge, which was, in turn, related to invented writing, had a poorer fit.

Furthermore, although the measures of invented writing in the current study mainly focused on the *encoding* and not on the *linguistic comprehension* factor of "the simple view of writing," the observed moderate indirect relationship between vocabulary and invented writing suggests that the "technical" aspects of literacy builds on the broader language system. This finding is in line with arguments forwarded by Walley et al. (2003) and, more recently, Hulme, Nash, Gooch, Lervåg, and Snowling (2015).

To what extent can the strong relationship between phonological awareness and invented writing be explained by the fairly transparent Norwegian orthography? Given the scarcity of relevant studies addressing these relationships, the answer to this question must be

indirect and mainly based on reading research. A number of studies have emphasized the impact of phonological awareness on reading skills in both deep and transparent orthographies (see Caravolas, Volin, & Hulme, 2005; Landerl & Wimmer, 2008; Lervåg, Bråten, & Hulme, 2009; Lundberg et al., 1988). However, breaking the alphabetic code is presumably easier in both transparent and semi-transparent orthographies than in deep orthographies (Seymour et al., 2003). There is no reason to believe that the degree of orthographic regularity would be of less importance to writing. In a study of the invented writing of five-year-olds using the deep orthography of English (Kim et al., 2014), the correlation coefficients between phonological awareness and invented writing skills were generally weaker than in the current study. A likely explanation is that it was easier for the Norwegian-speaking children to identify phonemes in words.

Limitations

We would like to draw attention to five potential limitations of this study. First, the sample size of 111 children reduces statistical power and invites caution when drawing generalizing conclusions. It should be noted, however, that the strength of the relationships amongst the observed variables was substantial, which adds to the study's statistical power and the validity of the results (Brown, 2015). Secondly, only one-third of the children attempted to write during the word-writing tasks, and even fewer were able to read. With no formal literacy training in preschool, this was a foreseeable result. Statistically, however, this produced floor effects for the writing and reading measurements, which subsequently influenced the statistical analyses. Therefore, MLR estimation was used to adjust the standard errors in the models and the reading data were only used descriptively. Third, there may be other variables that potentially affect writing skills that were not included in the model, including, most prominently, cognitive skills; motivation; access to writing material; participation in interactions about letters, sounds and writing among siblings, mates, and,

more generally, in preschool (Dyson, 2013). Fourth, we used indirect measures of children's home literacy environments in the form of parental self-reporting and did not include parental teaching as a marker. Fifth, this study is concurrent and not longitudinal by design. The interrelations between phoneme awareness, invented writing and letter knowledge could have emerged differently, e.g., reciprocally, had they been studied longitudinally. Invented writing and letter knowledge might have led to better phoneme awareness as well as the other way around. Despite these limitations, however, the main findings are in line with a substantial body of results observed across different learning contexts and orthographies. Therefore, we tend to see them as mutually validating and rather robust.

Conclusions

We have investigated the concurrent relations among parental education, children's home literacy environment, and five-year-olds' emerging literacy skills, with a specific focus on emergent writing skills. The main results demonstrate (a) significant relationships between the home literacy environment and the children's vocabulary knowledge, phonological awareness, and (via these skills) invented writing skills, (b) the pivotal role that phonological awareness appears to play during the period when children break the alphabetic code, and (c) how letter knowledge depend on phonological awareness skills to become functional entities (Frost, 2001). The observed variations in invented writing skills among the children were considerable and their alphabetic writing skills were generally rather low. These findings highlight the importance of home literacy, vocabulary and phonological awareness to children's preschool emergent writing skills.

Our findings expand theory underscoring that phonological skills are rooted in oral language skills (Walley et al., 2003) and that these skills are anchored in the habits and attitudes of children's home literacy environment. Often seen as an individual skill, the results underscore that writing is a skill that requires support from the home and preschool

environments to become internalized and function as the child's own tool of communication (Dyson, 2013; Treiman & Kessler, 2014; Vygotsky, 1978). Some children (e.g., children who experience little support in their home environments) may depend on adapted and more intensive support in preschool to avoid falling behind in their literacy development (Bourdieu & Passeron, 2006; Burgess et al., 2002; NELP, 2008).

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Table 1.

Language and literacy measures: means, standard deviations, reliabilities, and score distribution of the raw scores

Variable (maximum)	Means	SD	Range	α	Skewness	Kurtosis
Home literacy						
Time read to (5)	2.89	1.42	0–5		.01	-1.05
Mothers' reading (5)	4.05	1.30	1–5		-1.16	.07
Fathers' reading (5)	3.60	1.68	0–5		-.78	-.89
Parental education						
Mothers' education	2.97	.96	0–4		-.39	-.75
(4)	2.51	1.00	0–4		-.12	-.11
Fathers' education (4)						
Vocabulary						
BPVS odd (72)	27.95	5.32	17–44	.83	-.25	.37
BPVS even (72)	26.90	5.63	12–40	.83	-.06	.07
Phonological awareness						
Sound matching (20)	5.96	4.59	0–19	.90	.79	.20
Blending (20)	4.26	3.66	0–15	.89	1.18	.63
Elision (20)	1.92	1.49	0–7	.62	1.35	2.45
Rhyme (16)	10.20	2.47	4–15	.56	-.43	-.29
Letter knowledge						
Vowels (9)	4.52	2.61	0–9	.75	.16	-.99
Consonants (15)	8.25	5.29	0–15	.93	-.11	-1.53
Word writing						
Words (60)	11.09	18.37	0–57	.98	1.33	.18
Non-words (24)	3.87	7.27	0–24	.96	1.65	1.18
Sentence writing (5)	2.14	1.71	0–5		.04	-1.22
Reading						

Words	1.16	3.01	0–17	.94	3.40	13.01
Non-words	1.04	2.65	0–14	.92	2.92	8.50

Table 2.

Correlations among the observed language and literacy variables

	1.	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**	**9.**	**10.**	**11.**	**12.**	**13.**	**14.**	**15.**
1. Shared book reading	-														
2. Mothers' reading	.52**	-													
3. Fathers' reading	.35**	.55**	-												
4. Mothers' education	.27**	.21*	.36**	-											
5. Fathers' education	.18	.16	.26**	.43**	-										
6. Vocabulary	.31**	.17	.26**	.27**	.21*	-									
7. Sound matching	.36**	.17	.13	.17	.19	.30**	-								
8. Blending	.13	.15	.09	.17	.15	.17	.53**	-							
9. Elision	.03	.04	.06	.06	.12	.24*	.26**	.35**	-						
10. Rhyme	.15	.11	.20*	.26**	.11	.29**	.30**	.32**	.28**	-					
11. Letter knowledge	.15	.09	.12	.10	.07	.27**	.45**	.52**	.25**	.47**	-				
12. Writing words	.19*	.12	.13	.11	.08	.30**	.60**	.70**	.42**	.35**	.66**	-			
13. Writing non-words	.13	.08	.08	.13	.10	.28**	.55**	.61**	.41**	.29**	.60**	.95**	-		
14. Sentence writing	.25**	.22*	.21*	.14	.02	.26**	.52**	.52**	.41**	.45**	.66**	.67**	.62**	-	
15. Reading words	.06	.02	.06	.13	.09	.17	.46**	.66**	.45**	.25**	.75**	.75**	.75**	.45**	-

16. Reading non-words	.09	.03	.06	.16	.11	.18	.46**	.67**	.47**	.27**	.79**	.79**	.79**	.48**	.96**

Note: * = *p* <.05, ** = *p* <.01

Table 3.

Factor loadings and items for the latent variables in the CFA model

Latent construct	Observed variable	Factor loading *β*	Standard error	t-value
Home literacy	Time read	.62	.085	7.34
	Mother read	.78	.075	10.39
	Father read	.70	.092	7.60
Parental education	Mothers' education	.73	.104	7.08
	Fathers' education	.59	.104	5.66
Vocabulary	BPVS odd	.89	.070	12.80
	BPVS even	.91	.063	14.38
Phonological awareness	Sound matching	.67	.064	10.59
	Blending	.77	.066	11.62
	Elision	.45	.111	4.01
	Rhymes	.45	.077	5.81
Letter knowledge	Vowels	.98	.029	34.42
	Consonants	.91	.028	32.29
Invented writing	Non-word	.94	.017	55.09
	Word	1.00	.006	182.16
	Sentence writing	.72	.039	18.46

Note. Standardized factor loadings *β* were significant at $p < .001$.

Table 4.

Correlations among the latent variables

	1.	2.	3.	4.	5.	6.
1. Home literacy	-					
2. Parental education	.52**	-				
3. Vocabulary	.33**	.39**	-			
4. Phonological awareness	.29*	.36*	.38**	-		
5. Letter knowledge	.17	.19	.33**	.72**	-	
6. Invented writing	.17	.13	.31**	.89**	.67**	-

Note. * = p <.05, ** = p <.01

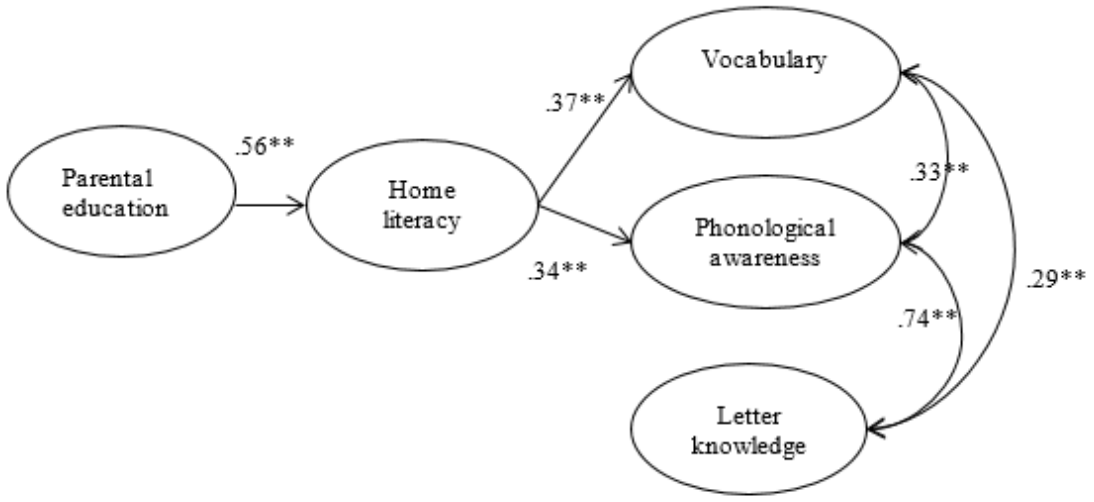

Figure 1. Structural Model I, hypothesizing a direct effect of parental education on home literacy and direct effects of home literacy on early literacy skills. Note. ** = p <.01; not significant effect from home literacy to letter knowledge.

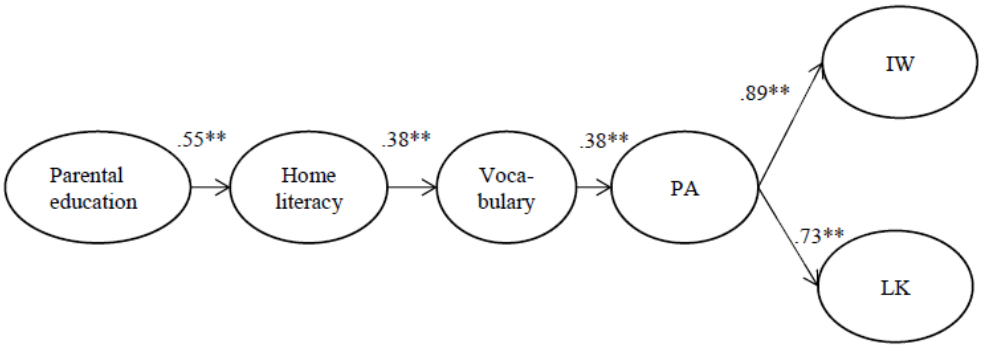

Figure 2. Structural Model II, hypothesizing direct effects between parental education, home literacy and phonological awareness, and phonological awareness accounting for the relations among invented writing and letter knowledge.

Note. PA = phonological awareness; LK = letter knowledge; IW = invented writing; ** = $p < .01$