



Letter-sound knowledge in Icelandic children at the age 6 years-old

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ABSTRACT

The aim of this study was to examine letter-sound knowledge when children start at school in Iceland. 392 children aged 5–6 years completed assessments of letter-sound knowledge, i.e., the names and sounds of uppercase and lowercase letters of the Icelandic alphabet (uppercase letter-name; uppercase letter-sound; lowercase letter-name; lowercase letter-sound). Whether the child had broken the reading code (could read words) was also recorded. The results revealed no significant difference between girls and boys in the four factors (letter name, letter sound). The results indicated that 56.9 % of the children had broken the reading code when they started school. 58.2 % of the girls and 55.6 % of the boys, not significant difference between the genders. There was a significant difference between the group which had broken the reading code and the group which have not in all the four factors. There was also a high significant correlation between all 4 variables from 0.915 between uppercase letter and lowercase sound to 0.963 between uppercase sounds and uppercase letter.

Based on these data, it seems reasonable to advocate learning letter-sound correspondences early in the first year of school to form the best possible basis for breaking the reading code and further reading development.

1. Introduction

Literacy is a driver for sustainable development in that it enables greater participation in the labor market, improves child and family health and nutrition, reduces poverty and expands life opportunities (Unesco, 2012). Effect of literacy empowers people, enables them to participate fully in society and contributes to improve livelihoods. Literacy is now understood as a means of identification, understanding, interpretation, creation and communication in an increasingly digital, text-mediated, information rich and fast changing world (Unesco, 2012). Reading is the basis for the acquisition of knowledge, for cultural engagement, for democracy, and for success in the workplace (Castles, Rastle, & Nation, 2018). Learning to read text with understanding is therefore one of the core aims of school education and adequate reading comprehension skills are essential for educational success and adult well-being (Chhabra & McCardle, 2004; Lervåg, Hulme, & Lervåg, 2018; Nation, 2019). As reading is the key to other keys in the educational systems, these should be prioritized tasks in the first 1–2 years of school (Solheim, Frijters, Lundetræ, & Uppstad, 2018).

Letter-sound knowledge has been found to be one of the most important factors for reading development (Chall, 1967; Bradley & Bryant, 1983; Ehri et al., 2001; Snow, Burns, & Griffin, 1998; Dehaene,

2011; Tønnesen & Uppstad, 2015; Solheim et al., 2018; Sunde, Furnes, & Lundetræ, 2019; Nation, 2019; Sigmundsson, Eriksen, Ofteland, & Haga, 2017; Sigmundsson, Dybfest Eriksen, Ofteland, & Haga, 2018; Sigmundsson, Haga, Ofteland, & Solstad, 2020). Development of letter-sound knowledge seems to be a matter of dynamic interaction between nature and nurture, in the sense of a multicausal explanation (Stoet & Geary, 2013). Dehaene (2011) argues that letter-sound correspondences must be systematically taught, one by one and that the amount of such teaching is the best predictor of reading performance. It is therefore necessary and indisputable that children need to understand the connection between letters and sounds when they learn to read (Adams, 1990; Castles et al., 2018; Dehaene & Cohen, 2011; Nation, 2019; Rose, 2006; Sigmundsson et al., 2020; Sigmundsson, Thórsdóttir, Njalsdóttir, & Hjaltafín, 2022).

Gough and Tunmer (1986) present a model for their theory, *Simple View of Reading* (SVR), to provide a broad model for understanding the role of decoding in reading comprehension and to identify potential sources of reading disabilities. This model posits that reading is the product of two independent components: decoding and language comprehension (Gough & Tunmer, 1986; Hoover & Gough, 1990). Decoding is clearly not sufficient for reading. But at the same time, we argue that decoding is necessary for reading, for if print cannot be

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translate into language, then it cannot be understood (Gough & Tunmer, 1986). Nation (2019, p.48) points out that: “decoding can be defined as the ability to identify words or print and linguistic comprehension as the ability to understand spoken language”. Decoding and language comprehension are necessary for reading comprehension and neither alone is sufficient. Weakness in either or both of components of the SVR are implicated in children’s reading comprehension difficulties (Hoover & Gough, 1990; Nation & Snowling, 2004; Brem et al., 2010; Hulme & Snowling, 2011; Nation, 2019). Breaking the reading code, that is, acquiring a mapping from graphemes to phonemes, is of high importance for children as it marks the point at which they can start to read words with two and three letters and progressively more complex texts (Ehri et al., 2001 for an overview). Sigmundsson et al. (2020) found out that letter knowledge was highly predictive of whether a child has broken the reading code or not. The average of all four letter-scores at the time they broke the reading code was 19 ± 5 letters (mean \pm standard deviation) in a sample of 356 Norwegian children aged 5–6 years. Research has also indicated gender differences in letter-sound knowledge when children enter school. When measuring the number of letter names and letter sounds, girls knew significantly more letters than boys (Sigmundsson, Eriksen, et al., 2017; Sigmundsson et al., 2018). Gender gaps in reading are shown in large scale academic assessment studies such as Programme for international Student Assessment (PISA) 2015 in 15-year-old children (OECD, 2016).

The predictive relationship between letter-sound knowledge and reading skill is well documented in English-speaking countries. In this respect, Noel Foulin (2005) points out that this knowledge for other languages has been called for. The relationship between letter knowledge and breaking the reading code in native Icelandic speakers when they start school is scarce in the literature. Icelandic is a semi-transparent language similar to Norwegian i.e., more transparent than English and Danish, but less transparent than Finnish and Italian (Seymour et al., 2003; Walgermo, Frijters, & Solheim, 2018). On a scale of 1 to 5 rating of languages according to phonetic regularity, Icelandic and Norwegian get a score 3, English score 1 (highly irregular) and Finnish score 5, (highly regular) (Elley, 1992).

In this study we investigated four research questions:

- Are there gender differences in letter-sound knowledge when children start school?
- Are there gender differences in how many children are able to break the reading code?
- Are there differences in how many letters and their sounds children know when they have broken the reading code or not?
- What is the correlation between the four factors in knowledge of letter-sounds: uppercase letters, uppercase letter sound, lowercase letters, lowercase sounds?

2. Methods

2.1. Study design and participants

A total of 392 children 5–6 years of age (born 2014 and 2015), 198 boys (50.4 %) and 194 girls (49.4 %), aged between 5 and 6 years were recruited for this study. The children were selected from 12 schools all-around Iceland in the school year 2020/2021 and two schools from the academic year 2021/2022 (convenience sampling from schools in Iceland that were invited to participate). The language orthography was Icelandic language. The mean chronological age for the entire group at the start of the project was 6.1 (SD = 0.3) years; the overall range was 5.67 to 6.67 years. The entire sample reflected the population of children attending schools in Iceland and included children in a wide range of socio-economic backgrounds. The children were attending their first year in school. The schools varied in size and location (from urban to suburban). All participants completed an assessment of letter knowledge (“Bokstavtesten”; Ofteland, 1992; Sigmundsson, Eriksen, et al., 2017;

Sigmundsson et al., 2018, 2020) in the start of the first school year.

2.2. Measurements

2.2.1. Letter knowledge

The Icelandic alphabet is based on the Latin alphabet and identical to the Danish alphabet. Icelandic language is considered to have a semi-transparent orthography (Esmaeeli, Lundetræ, & Kyle, 2018).

Knowledge of letter names and letter sounds was assessed using the Letter-sound knowledge test (LSK test; “Bokstavtesten”; Ofteland, 1992; Sigmundsson, Eriksen, et al., 2017; Sigmundsson et al., 2018, 2020). The LSK test measures a participant’s knowledge of the names and sounds of Norwegian uppercase letters (“A, B, C, ...”) and lowercase letters (“a, b, c, ...”). The participant is presented with the grapheme of each letter of the alphabet in turn and is scored asked to verbally produce both the name and the sound (phoneme) of each letter. There are 35 letters in the Icelandic alphabet. Each name and each sound that the participant correctly produces is scored 1 point, for a maximum total score of 4×35 points = 140 points.

The LSK test takes about 10 min per participant. It has two sheets, one for the uppercase letters and one for the lowercase letters.

The convergent construct validity of the test battery was estimated by comparing the rankings of the test scores in a class of 20 Norwegian six-year-old children (mean age 6.05, SD 0.28) with the rankings of the same children based on an evaluation of their teacher. There was a close association between the rankings based on the teacher’s evaluation and the rankings of test scores, with a Spearman rho correlation of 0.683.

The relative test-retest reliability of the test battery was estimated by the intraclass correlation coefficient (ICC (2,1); Shrout & Fleiss, 1979). The results indicated good reliability for individual test item scores, with ICCs between test and retest scores ranging from 0.985 to 0.992 (Sigmundsson, Eriksen, et al., 2017). Based on a questionnaire to teachers involved in the project, a common understanding about when a child has broken the reading code was established. “... a child has broken the reading code when it is able to read short one- and two-syllable words, in uppercase letters, with slow, almost hesitant decoding (close to fluent decoding). These words are without accumulation of consonants” (Sigmundsson et al., 2020, p.2). Each child had a test sheet for the three test points, one for the uppercase and one for the lowercase letters. In addition, each teacher had sheets with one- and two-syllable words in uppercase letters and lowercase letters together with shorter sentences to test whether children had broken the reading code. “Whether learning to read occurs in stages (e.g. Gough & Hillinger, 1980) or proceeds by incremental acquisition of experiences giving rise to stage-like changes in behavior (e.g. McClelland, 1995), beginning to read short words is an observable behavior indicating progress towards reading proficiency.” (Sigmundsson et al., 2020, p. 2).

2.3. Procedure

Full ethical review and approval was not required for this study in accordance with the national and institutional guidelines. However, the study was carried out in accordance with the recommendations of the Icelandic Data Protection Authority and the Declaration of Helsinki (World Medical Association, 1964).

Permission for data collection was obtained following a presentation of the project at a meeting for school leaders in the participating schools, and principals of all participating schools were informed about the project. The project was carried out as part of the school curriculum. The only information the project leader got, from the schools, was children’s age, gender and the score on the letter-sounds knowledge test. Prior to the data collection, information about the nature of the study was given in verbal form to the children. The participants were given an opportunity to withdraw from the test without providing the reason. Identification numbers were used to maintain data confidentiality. The assessment took place in a quiet room during normal school hours and

was conducted in accordance with the LSK manual. All participants were tested individually by teachers that had been trained in the test protocol; The Letter-sound knowledge test; of the project leader before testing started. Each child answered the test early in the school year (September).

Each test item was explained and demonstrated before the participants started.

2.4. Data analysis

For the statistical analysis, SPSS version 25 was used. Mann Whitney U test was used to test for significant differences between the variables.

3. Results

3.1. Research question 1

A Mann-Whitney U test was used to investigate gender differences on letter-sound knowledge. The results indicated no significance difference between the girls (N = 194) and boys (N = 198) regarding how many letter-sound they know at the beginning at the school year.

Uppercase letters: girls had a mean score of 23.96 (SD = 9.08) and boys had a mean score of 23.73 (SD = 9.00). U = 18,826, p = .735.

Uppercase sound: girls had a mean score of 22.25 (SD = 8.64) and boys had a mean score of 21.61 (SD = 8.60). U = 17,729, p = .187.

Lowercase letters: girls had a mean score of 21.88 (SD = 9.96) and boys had a mean score of 21.89 (SD = 9.84). U = 19,148, p = .959.

Lowercase sound: girls had a mean score of 20.73 (SD = 10.13) and boys had a mean score of 20.22 (SD = 9.99). U = 18,549, p = .558.

3.2. Research question 2

113 of 194 (58.2 %) of the girls had broken the reading code when they started school and 110 of 198 (55.6 %) of the boys had broken the reading code when they started school. The difference between groups was not significant (U = 18,689, p = 0.591).

3.3. Research question 3

There was a significant difference between the group which had broken the reading and the group which have not in all the four variables (see Table 1).

3.4. Research question 4

As Table 2 indicates there was a high significant correlation between all 4 variables from 0.915 between uppercase letter and lowercase sound to 0.963 between uppercase sounds and uppercase letter.

Table 1
Letter-sound knowledge for children who had breaking the reading code or not.

	Reading code broken		Reading code not broken	
	(N = 223)		(N = 169)	
	Mean (SD)		Mean (SD)	U-value p ^a
Uppercase letter names	28.84 (5.14)		17.25 (8.83)	5071 <0.001
Uppercase letter sound	26.55 (5.46)		15.83 (8.22)	5752 <0.001
Lowercase letter name	27.03 (7.11)		15.09 (8.89)	5824 <0.001
Lowercase letter sound	25.96 (7.14)		13.23 (8.66)	5241 <0.001

^a Mann-Whitney U test.

Table 2
Correlation between uppercase letter names, uppercase letter sound, lowercase letter names and lowercase letter sounds.

	Uppercase name	Uppercase sound	Lowercase name	Lowercase sound
Uppercase name	1	0.963**	0.939**	0.915**
Uppercase sound		1	0.934**	0.959**
Lowercase name			1	0.949**
Lowercase sound				1

** Correlation is significant on 0.01 level (2-tailed) (Pearson).

4. Discussion

In this study we examined knowledge of letter names and letter sounds in 392 Icelandic children at the age 5–6 years.

Overall, 56.9% of the children who had broken the reading code, were able to read single words. There were also no gender differences in relation to the variables measured.

4.1. Letter-sound knowledge – gender differences

The findings indicated no significant difference between the genders regarding how many uppercase letters, uppercase sound, lowercase letters and lowercase sound, the children know at the beginning at school. That is not in line with the study of Sigmundsson, Eriksen, et al. (2017) on Norwegian school starters. They found significant differences between genders on all the four factors, in favor of the girls.

4.2. How many had broken the reading code when starting school

We found that 56.9 % of the children had already acquired reading skills before entering school, suggesting that they had received sufficient specific training, systematic practice and experience (Kleim & Jones, 2008) related to reading (Castles et al., 2018; Nation, 2019; Sigmundsson et al., 2020, 2022; Solheim et al., 2018; Walgermo et al., 2018). Sigmundsson et al. (2020) found that in Norwegian first graders, that 11 % had broken the reading code at school start. Of this 11 % 70 % were girls. So, 56 % Icelandic and 11 % Norwegian children have got sufficient practice to be able to read (Ericsson & Pool, 2016; Sigmundsson, Trana, Polman and Haga, 2017).

This difference between Iceland and Norway may be related to the pedagogic processes (pedagogy) carried out in the kindergarten. In Norway there is no focus on teaching children letter or sound. While in Iceland there is much focus on teaching letter-sound in the nursery home.

If we look at the PISA score Icelandic adolescents have this score 474, girls 494 and boys 454. While Norwegian adolescents have 499, girls 523 and boys 476 (OECD, 2019). That there is a difference of 45 % i.e., more children who have broken the reading code when they start school seems not to have any effect on reading comprehension 10 years later. In relation to the studies of Sigmundsson, Eriksen, et al. (2017) and Sigmundsson et al. (2018, 2020) on Norwegian school starters the gender differences found in PISA 2018 may be related to the differences already found at age 6 year. However, in this study, the lack of gender differences for school starts indicates that the difference occurs later.

4.3. Difference in letter-sound knowledge between group who had broken the reading code or not

In this study we found that letter knowledge was highly predictive of whether a child had broken the reading code or not. The children who had broken the reading code had uppercase letter name mean score of

28.84 (SD 5.14) and lowercase letter name of 27.03 (SD 7.11). The children who had not broken the reading code had uppercase letter name mean score of 17.25 (SD 8.83) and lowercase mean score of 15.10 (SD 8.89).

These findings lend support to a large body of research advocating the importance of letter-sound knowledge for breaking the reading code and developing reading competency (Adams, 1990; Chall, 1967; Bradley & Bryant, 1983; Castles et al., 2018; Dehaene, 2009, 2011; Dehaene & Cohen, 2011; Ehri et al., 2001; Snow et al., 1998; Tønnesen & Uppstad, 2015; Solheim et al., 2018, Sunde et al., 2019; Nation, 2019; Rose, 2006; Sigmundsson, Eriksen, et al., 2017; Sigmundsson et al., 2018, 2020, 2022).

Existing research has shown that children benefit from reading instruction when connections between phonemes and graphemes are taught explicitly (National Institute of Child Health and Human Development, 2000; Sunde et al., 2019; Dehaene, 2011).

4.4. Correlations between the four factors

It is of interest to see the very high correlation between the four factors. The correlations range from 0.915 to 0.963. This may indicate that learning uppercase letters and sounds may have high effect of learning lowercase letters and sounds and vice versa. Children who know uppercase letters may also know lowercase letters. This is in line with Sigmundsson, Eriksen, et al. (2017) findings in a group of Norwegian first graders. They found that the correlation between the factors was from 0.848 to 0.939.

4.5. Limitations

One limitation of the study was that we do not have information of what their practice was before the children did start the school. The children who were able to read words, when starting school, have had training and practice. Research indicate that specific training and systematic practice are required to effectively learn the letters and their sounds (Kleim & Jones, 2008; Sigmundsson et al., 2020, 2022). It would have been interesting to have more information about other skills of the children participating in the study.

5. Conclusion

The most important findings from this study focusing on Icelandic school starters was that 56.9% had broken the reading code. In addition, it was of great interest that there were no gender differences related to any of the four factors. In Iceland we are now following this findings with a longitudinal study 'Kveikjum neistann!' (Ignition) in Vestmannaeyjar. There we use newly developed perspective which we call 'READ'. READ builds on the phonics approach which is found to be most important for reading achievement (Dehaene, 2011; Rose, 2006). In addition, it builds on theories within learning and skill development i.e. deliberate practice, flow (challenges in relation to skills) and motivational factors (Ericsson & Pool, 2016; Csikszentmihalyi, 1975; Sigmundsson et al., 2022).

Declaration of competing interest

We here confirm that there are no conflicts of interest related to this study.

Data availability

Data will be made available on request.

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