

**Reading fluency and ADHD symptoms:**

**Initial testing of IS-FORM, IS-PSEUDO, and SWAN in a sample of Icelandic children**

*Heida Maria Sigurdardottir\*, Ingibjorg Erla Jonsdottir†, Logi Ulfarsson† & Freyja*

*Birgisdottir, Department of Psychology, University of Iceland*

*\* Corresponding author (heidasi@hi.is)*

*† Equal contribution*

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## Íslenskur útdráttur

Rannsóknin snýr að fyrstu prófun á þremur matstækjum í litlu úrtaki íslenskra barna. Matstækin voru lesprófin IS-FORM og IS-PSEUDO ásamt SWAN-spurningalistanum (Strengths and Weaknesses of ADHD-symptoms and Normal-behavior). Þátttakendur voru börn í fjórða bekk grunnskóla í Reykjavík (10 stúlkur og 10 drengir). Forráðamenn voru beðnir um að meta hegðun barna sinna með SWAN-listanum. Rannsakendur mátu svo lesfimi barnanna með því að láta þau lesa íslensk orð (IS-FORM) og orðleysur (IS-PSEUDO). Frekari upplýsingar um lesfimi (skor á staðlaða matstækinu Lesferli) ásamt einkunnum í samræmdum könnunarprófum í fjórða bekk (íslenska og stærðfræði) voru fengnar hjá Menntamálastofnun. IS-FORM og IS-PSEUDO sýndu öll merki þess að vera bæði áreiðanleg og réttmæt matstæki fyrir lesfimi barna í fjórða bekk. SWAN-listinn reyndist einnig mjög áreiðanlegur (Cronbach's alpha var 0.96). Föst tveggja þátta lausn skipti SWAN í tvo meginþætti sem samsvöruðu vel undirlistum SWAN fyrir athyglisbrest annars vegar og ofvirkni/hvatvísi hins vegar. SWAN-skor fylgdust að við allar mælingar á lestri, en ekki við einkunnir í samræmdum könnunarprófum, og fylgnin við lesfimi jókst frá öðrum til fimmta bekkjar. Niðurstöðurnar benda til að einkenni og hegðun tengd athyglisbrests- og ofvirkniröskun (ADHD) hindri börn í að ná fullri lesfimi.

## English Abstract

The small-scale study presented here was the first test of three instruments in a sample of Icelandic children: IS-FORM, IS-PSEUDO, and the Strengths and Weaknesses of ADHD-symptoms and Normal-behavior (SWAN) rating scale. Participants in this study were children in the 4<sup>th</sup> grade of a school in Reykjavik (10 girls and 10 boys). Guardians completed SWAN to assess their children's behavior. The researchers measured children's reading fluency for real Icelandic word forms (IS-FORM) and pseudowords (IS-PSEUDO) onsite. Lesferill standardized reading fluency exam scores and both Icelandic language and mathematics scores from the 4<sup>th</sup> grade Icelandic National Exams (academic achievement) were collected from the Directorate of Education. IS-FORM and IS-PSEUDO showed all signs of being reliable and valid instruments for assessing the reading fluency of 4<sup>th</sup> grade children (Chronbach's alpha for the IS-FORM 1, IS-FORM 2, and IS-PSEUDO together was .87). SWAN also had excellent reliability in our sample (Cronbach's alpha of .96). A forced two-factor solution provided a factor structure that aligned well with the ADHD-Inattentive and ADHD-Hyperactive/Impulsive subscales of SWAN. SWAN scores correlated with all reading measures, but not significantly with academic achievement, and the strength of this association got stronger from 2<sup>nd</sup> to 5<sup>th</sup> grade. The results suggest that ADHD-related symptoms and behavior hinder children from reaching their full reading fluency potential.

Dyslexia ranks among the most common learning disabilities (Shaywitz & Shaywitz, 2005), with prevalence estimates of 5-17.5% (Shaywitz, 1998). Although dyslexia's exact prevalence in Iceland remains unclear, a report made by the Ministry of Education in Iceland (Menntamálaráðuneyti, 2007) based on results of the OECD PISA report indicated that the prevalence of severe reading problems among 15-year-olds in Iceland is 4%, and another 10% are at a disadvantage. Moreover, reading problems appear to be persistent; children who fail to read sufficiently by the first grade have a 90% probability of having reading problems in the 4<sup>th</sup> grade, and a 75% probability of reading poorly in high school (Gabrieli, 2009). Early screening and intervention is therefore imperative.

The IS-FORM (Sigurdardottir et al., 2015) and IS-PSEUDO (Sigurdardottir et al., 2017) reading fluency tests are designed to encompass a wide dimension of reading abilities. They have been used in research on dyslexic and typical adult readers of Icelandic whose performance differs greatly on the tests. However, because neither IS-FORM nor IS-PSEUDO have been tested on children, it remains unclear to what degree the tests are useful for identifying children with reading impairments. IS-FORM involves the reading of familiar and unfamiliar Icelandic word forms; word form frequency was originally collected from the Icelandic frequency vocabulary book (Pind et al., 1991). The test is explicitly designed to slow down the pace of letter-by-letter readers and increase their error rate as the ending of word forms cannot be guessed from their context. The IS-PSEUDO involves the reading of pseudowords that adhere to the rules of the Icelandic language. Difficulty with reading phonologically valid pseudowords has been shown to be highly predictive of dyslexia among English speaking children (Shaywitz et al., 1998).

Attention Deficit Hyperactivity Disorder (ADHD) is another common disorder with about 5% of children worldwide meeting diagnostic criteria (Njarðvík, 2017). Dyslexia and ADHD are comorbid (Germanò et al., 2010; Willcutt & Pennington, 2000). Children with

reading disability are more likely than other children to meet criteria for ADHD, and this association with reading problems appears to be stronger for ADHD inattentive symptoms than for ADHD symptoms of hyperactivity-impulsivity (Willcutt & Pennington, 2000).

The Strengths and Weaknesses of ADHD-symptoms and Normal-behavior (SWAN) rating scale is intended to measure dimensions of ADHD-related symptoms in the normal population (Swanson et al., 2012). Unlike most other ADHD rating scales, SWAN is designed to assess both strengths and weaknesses by providing positively framed assertions (e.g. “Gives close attention to detail and avoids careless mistakes“). SWAN is intended to have greater variation than most screening instruments more specifically aimed at identifying children with ADHD. Although prior research has demonstrated SWAN’s good reliability and validity (Arnett et al., 2013; Hay, Bennett, Levy, Sergeant & Swanson, 2007; Lakes, Swanson & Riggs, 2011; Polderman et al., 2007; Swanson et al., 2012), it has never been tested with Icelandic children.

The main aims of the small-scale study presented here were threefold: a) to estimate the reliability and validity of IS-FORM and IS-PSEUDO as measures of children’s reading fluency, b) to explore the reliability and factor structure of the Icelandic translation of SWAN, and c) to examine the specific association between dimensions of ADHD-related symptoms, as estimated by SWAN, and reading.

## **Method**

### **Participants**

Participants in this study were 4<sup>th</sup> grade children from one school in Reykjavik. Parents or guardians of all children in the 4<sup>th</sup> grade of the school were contacted, with 20 providing their informed written consent for the participation of their child (10 girls and 10

boys). Children assessed by the researchers gave verbal consent. Data on minutes spent reading per day, interest in reading, and Strengths and Weaknesses of ADHD-symptoms and Normal-behavior (SWAN) rating scale scores were collected for all 20 children. IS-FORM and IS-PSEUDO reading tests were administered to 19 children, Lesferill reading fluency scores (fluency measures nr. 1-10) were collected for 18 children (with one additional missing value for fluency measures no. 1 and 3), and Icelandic language and mathematics scores from the 4<sup>th</sup> grade Icelandic National Exams were collected for 18 children.

### **Test materials and procedure**

The experimental protocol was reviewed by the University of Iceland Science Review Board and reported to the Data Protection Authority. Permission was received from both the Directorate of Education and the Department of Education and Youth in Reykjavik. The school in question was then contacted and information letters describing the study, along with a written consent form, were sent to the guardians of all 4<sup>th</sup> grade children. Guardians (in March-April 2019) filled out SWAN and answered background questions regarding their child, two of which are included in the current analysis: 1) How many minutes does your child read on average per day? (This refers to reading outside school hours), and 2) How much do you agree or disagree with the following statement: My child is very interested in reading (5-point Likert scale; 1 = strongly disagree; 5 = strongly agree). Children's reading ability was assessed onsite (in April 2019) by the researchers who administered two reading tests, the IS-FORM (two lists, IS-FORM 1 and 2, of real Icelandic word forms; Sigurdardottir et al., 2015) and the IS-PSEUDO (list of pseudowords; Sigurdardottir et al., 2017). No compensation or reimbursement was given for participation in the study.

Participants were tested one by one in an otherwise empty conference room. They were asked to read aloud the three (pseudo)word lists in the following order: IS-FORM 1, IS-

FORM 2 and finally IS-PSEUDO. Children also had the opportunity to participate in an object recognition test (out of scope for the current article). Finally, children's results for Lesferill standardized reading fluency exams as well as Icelandic language and mathematics scores from the 4<sup>th</sup> grade Icelandic National Exams were collected from the Directorate of Education in Iceland.

## **Materials**

**IS-FORM and IS-PSEUDO.** The IS-FORM (Sigurdardottir et al., 2015) consists of two lists of words, one with 128 common Icelandic word forms (IS-FORM 1) and the other with 128 uncommon word forms (IS-FORM 2). The IS-PSEUDO (Sigurdardottir et al., 2017) is comprised of 128 pseudowords. Children were asked to read out loud as many (pseudo)words as they could in one minute, but to still take care to read each word correctly. Outcome scores were the total number of correctly read (pseudo)words per minute.

**SWAN.** The Icelandic version of the Strengths and Weaknesses of ADHD-symptoms and Normal-behavior (SWAN) rating scale, used for the first time in this study, was translated by psychologist Jóhanna Cortes Andrésdóttir, and the translation was then further validated by the current authors (see Appendix). The SWAN is comprised of 18 assertions based on diagnostic criteria for ADHD diagnosis, measuring inattentive, hyperactive, and impulsive behaviors (Swanson et al., 2012). Each question is rated on a balanced 7-point Likert scale, with anchors of -3 = far below average, -2 = below average, -1 = slightly below average, 0 = average, 1 = slightly above average, 2 = above average, and 3 = far above average. Guardians were asked to respond to each assertion based on their children's behavior for the past six months (Hay, Bennett, Levy, Sergeant & Swanson, 2007; Swanson et. al., 2012). A summary score was then calculated as the average rating-per-item, where a lower score indicated greater ADHD-related behaviors.

**Lesferill and National Exams.** Results from two tests were collected from the Directorate of Education in Iceland: Lesferill standardized reading fluency exams as well as Icelandic language and mathematics scores (including subscores) from the 4<sup>th</sup> grade standardized Icelandic National Exams. Lesferill was administered ten times (in the months of January, May, and September) from the beginning of 2<sup>nd</sup> grade (September 2016) to the beginning of 5<sup>th</sup> grade (September 2019) by the children's teachers. The ten assessments will be referred to as fluency 1-10. Each time, the number of correctly read words per minute was calculated. The 4<sup>th</sup> grade Icelandic National Exams in mathematics and the Icelandic language were administered in September 2018. Two total scores were calculated, referred to as Maths total and Language total. Mathematics and language subscores were also gathered from the Directorate of Education: Maths 1: Arithmetic and operations; Maths 2: Numbers and number comprehension; Maths 3: Geometry; Language 1: Reading comprehension; Language 2: Language use.

## Results

### IS-FORM and IS-PSEUDO Reliability and Validity

As the IS-FORM and IS-PSEUDO have never been used to assess children's reading skills before, their reliability and validity was estimated. The three reading lists (IS-FORM 1, IS-FORM 2, and IS-PSEUDO) were all strongly positively correlated (all  $r_s > .84$ , all  $p_s < .001$ ; figure 1) with a Chronbach's alpha for the three reading lists together of .87. The three lists were also strongly correlated with all Lesferill fluency estimates (all  $r_s > .81$ , all  $p_s < .001$ ; figure 1), providing evidence for convergent validity of these estimates of reading fluency.

IS-FORM 1 (common word forms) and IS-FORM 2 (uncommon word forms) were also correlated when IS-PSEUDO was partialled out ( $r_{\text{partial}} = .78$ ,  $p < .001$ ). The same was

true for IS-FORM 2 and IS-PSEUDO when IS-FORM 1 was partialled out, ( $r_{\text{partial}} = .67, p = .002$ ), but there was no significant correlation between IS-FORM 1 and IS-PSEUDO when partialling out IS-FORM 2 ( $r_{\text{partial}} = -0.13, p = 0.619$ ). This provides evidence for divergent validity as the lists appear to capture sub-measures of the reading of familiar and unfamiliar material.

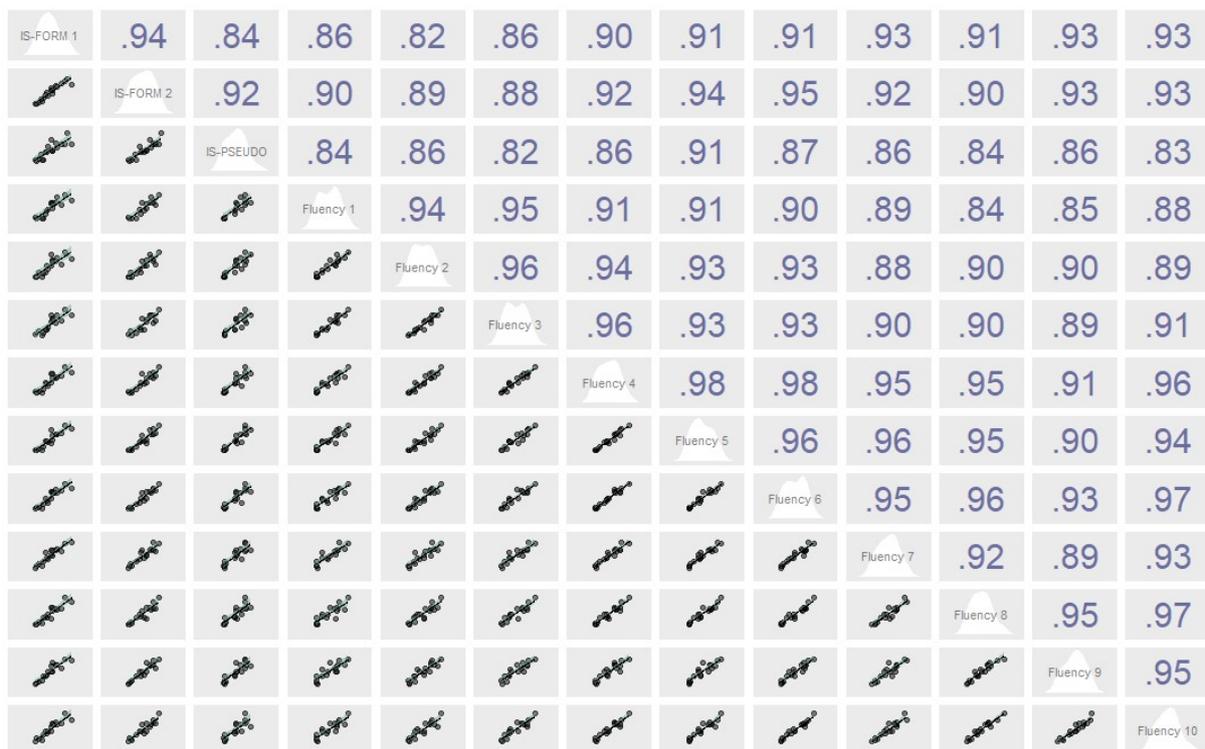


Figure 1. Correlation matrix for all reading tests (IS-FORM, IS-PSEUDO, and Lesferill reading fluency). Upper triangle shows Pearson's  $r$  correlation coefficients, lower triangle shows scatterplots with linear fits and 95% confidence bands, and the diagonal shows univariate density plots. All correlation coefficients are significant (alpha level: .05).

There were also significant relations between IS-FORM 1/IS-FORM 2/IS-PSEUDO and both the guardians' reports on how many minutes their children read per day (all  $r$ s > 0.52; all  $p < 0.022$ ) and their children's reading interest (all  $r$ s > 0.53; all  $p < 0.020$ ; figure 2). The more children read on average per day and the greater their interest in reading, the better

they did on the IS-FORM and IS-PSEUDO reading tests. This provides further support for the validity of these lists as measures of children's reading abilities.

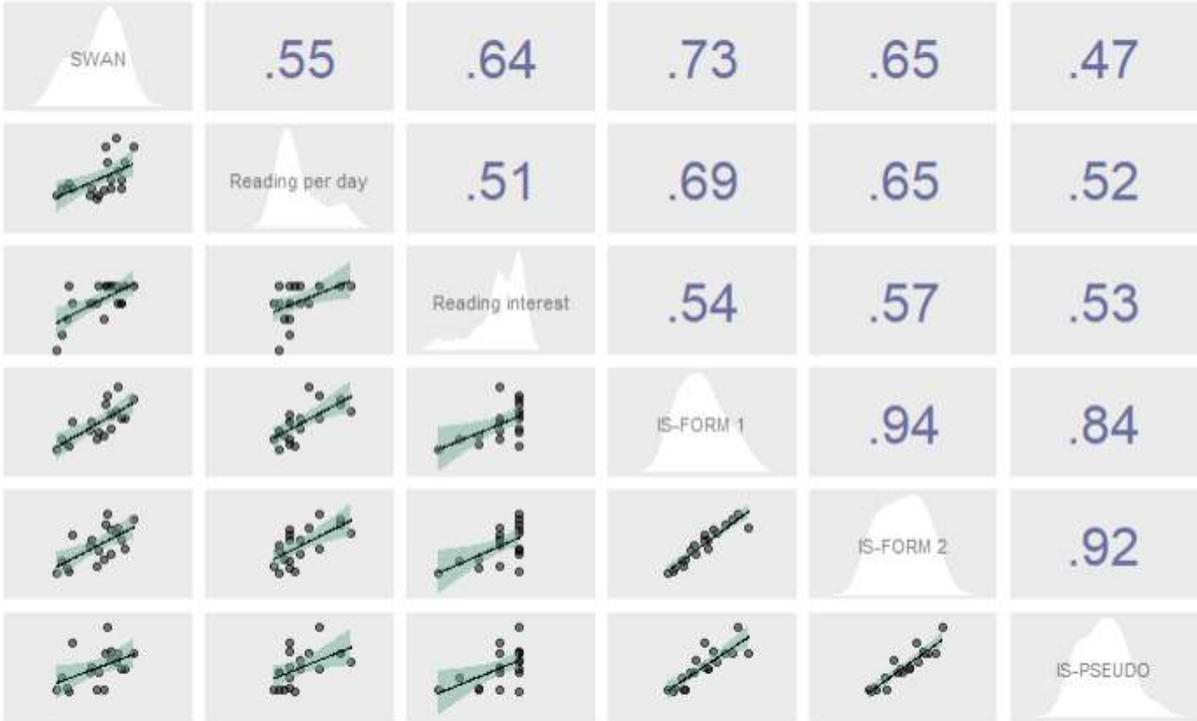


Figure 2. Correlation matrix for SWAN and concurrently assessed reading measures. Upper triangle shows Pearson's *r* correlation coefficients, lower triangle shows scatterplots with linear fits and 95% confidence bands, and the diagonal shows univariate density plots. All correlation coefficients are significant (alpha level: .05).

**SWAN Reliability and Factor Structure**

SWAN score sample mean was 0.48 (SD = 1.28) which was not significantly different from zero ( $t(19) = 1.68, p = 0.110$ ). This suggests that anchors (e.g. 0 = average) provided for the respondents of SWAN were indeed used as intended. The scale had high internal consistency as determined by a Cronbach's alpha of .96. All scale items were positively correlated with the total score where corrected item-total correlations ranged from .43 (item 18) to .97 (item 10).

A principal component analyses with varimax rotation was performed on SWAN items. Extraction was based on Eigenvalues exceeding 1. The questions loaded on three components explaining 83% of the total variance of the rating scale (table 1). However, when a two-factor structure was forced (PCA with varimax rotation), items 1-9 had higher loadings on the first principal component while items 10-18 loaded higher on the second principal component (table 2). The two factors explained a total of 76% of the variance.

*Table 1. Principal component analyses for SWAN with tentative component titles. Highest loadings for each item are bolded and underlined.*

	Components		
	1: ADHD combined	2: ADHD inattentive	3: ADHD hyperactivity
1. Gives close attention to detail and avoids careless mistakes	.47	<b><u>0.59</u></b>	0.25
2. Sustains attention on tasks or play activities	.65	<b><u>0.66</u></b>	0.20
3. Listens when spoken to directly	<b><u>0.74</u></b>	0.37	0.33
4. Follows through on instructions and finishes school work and chores	<b><u>0.77</u></b>	0.37	0.19
5. Organizes tasks and activities	0.52	<b><u>0.79</u></b>	0.00
6. Engages in tasks that require sustained mental effort	-0.11	<b><u>0.86</u></b>	0.38
7. Keeps track of things necessary for activities (doesn't lose them)	<b><u>0.76</u></b>	0.27	0.03
8. Ignores extraneous stimuli	0.34	<b><u>0.81</u></b>	0.14
9. Remembers daily activities	0.53	<b><u>0.63</u></b>	-0.14
10. Sits still (controls movement of hands or feet or controls squirming)	<b><u>0.76</u></b>	0.43	0.44
11. Stays seated (when required by class rules or social conventions)	<b><u>0.83</u></b>	0.27	0.41
12. Modulates motor activity (inhibits inappropriate running or climbing)	<b><u>0.81</u></b>	0.18	0.47
13. Plays quietly (keeps noise level reasonable)	<b><u>0.73</u></b>	0.13	0.50
14. Settles down and rests (controls constant activity)	<b><u>0.74</u></b>	0.25	0.50
15. Modulates verbal activity (controls excessive talking)	0.61	0.28	<b><u>0.65</u></b>
16. Reflects on questions (controls blurting out answers)	0.42	0.16	<b><u>0.78</u></b>
17. Awaits turn (stands in line and takes turns)	0.50	0.20	<b><u>0.75</u></b>
18. Enters into conversation and games without interrupting or intruding	0.03	0.05	<b><u>0.91</u></b>

Table 2. Principal component analyses for SWAN with tentative component titles, with a forced two-factor solution. Highest loadings for each item are bolded and underlined.

	Components	
	1: ADHD inattentive	2: ADHD hyper./imp.
1. Gives close attention to detail and avoids careless mistakes	<b><u>0.69</u></b>	0.38
2. Sustains attention on tasks or play activities	<b><u>0.85</u></b>	0.42
3. Listens when spoken to directly	<b><u>0.64</u></b>	0.61
4. Follows through on instructions and finishes school work and chores	<b><u>0.69</u></b>	0.50
5. Organizes tasks and activities	<b><u>0.93</u></b>	0.16
6. Engages in tasks that require sustained mental effort	<b><u>0.56</u></b>	0.17
7. Keeps track of things necessary for activities (doesn't lose them)	<b><u>0.63</u></b>	0.37
8. Ignores extraneous stimuli	<b><u>0.81</u></b>	0.19
9. Remembers daily activities	<b><u>0.83</u></b>	0.07
10. Sits still (controls movement of hands or feet or controls squirming)	0.68	<b><u>0.70</u></b>
11. Stays seated (when required by class rules or social conventions)	0.60	<b><u>0.73</u></b>
12. Modulates motor activity (inhibits inappropriate running or climbing)	0.50	<b><u>0.78</u></b>
13. Plays quietly (keeps noise level reasonable)	0.41	<b><u>0.78</u></b>
14. Settles down and rests (controls constant activity)	0.51	<b><u>0.77</u></b>
15. Modulates verbal activity (controls excessive talking)	0.43	<b><u>0.83</u></b>
16. Reflects on questions (controls blurting out answers)	0.20	<b><u>0.86</u></b>
17. Awaits turn (stands in line and takes turns)	0.29	<b><u>0.87</u></b>
18. Enters into conversation and games without interrupting or intruding	-0.13	<b><u>0.79</u></b>

### SWAN Relationship with Reading and General School Ability

Five reading measures were collected concurrently with SWAN: Reading per day (minutes), reading interest (5-point Likert scale), IS-FORM 1 (common word forms correctly read per minute), IS-FORM 2 (uncommon word forms correctly read per minute) and IS-PSEUDO (pseudowords correctly read per minute). There was a significant positive correlation between SWAN and all five reading measures (figure 2). SWAN was positively correlated with the reading of real words (mean IS-FORM scores across both lists) when partialling out IS-PSEUDO ( $r_{\text{partial}} = 0.71, p = 0.001$ ) but negatively and non-significantly

correlated with the reading of IS-PSEUDO pseudowords when partialling out real-word reading from IS-FORM ( $r_{\text{partial}} = -0.46, p = 0.053$ ). SWAN was also positively correlated with the reading of real words when partialling out reading per day ( $r_{\text{partial}} = 0.52, p = 0.028$ ), interest in reading ( $r_{\text{partial}} = 0.55, p = 0.019$ ), or gender ( $r_{\text{partial}} = 0.78, p < 0.001$ ), and with IS-PSEUDO when partialling out gender ( $r_{\text{partial}} = 0.51, p = 0.030$ ) but not reading per day ( $r_{\text{partial}} = 0.23, p = 0.356$ ) or interest in reading ( $r_{\text{partial}} = 0.18, p = 0.469$ ).

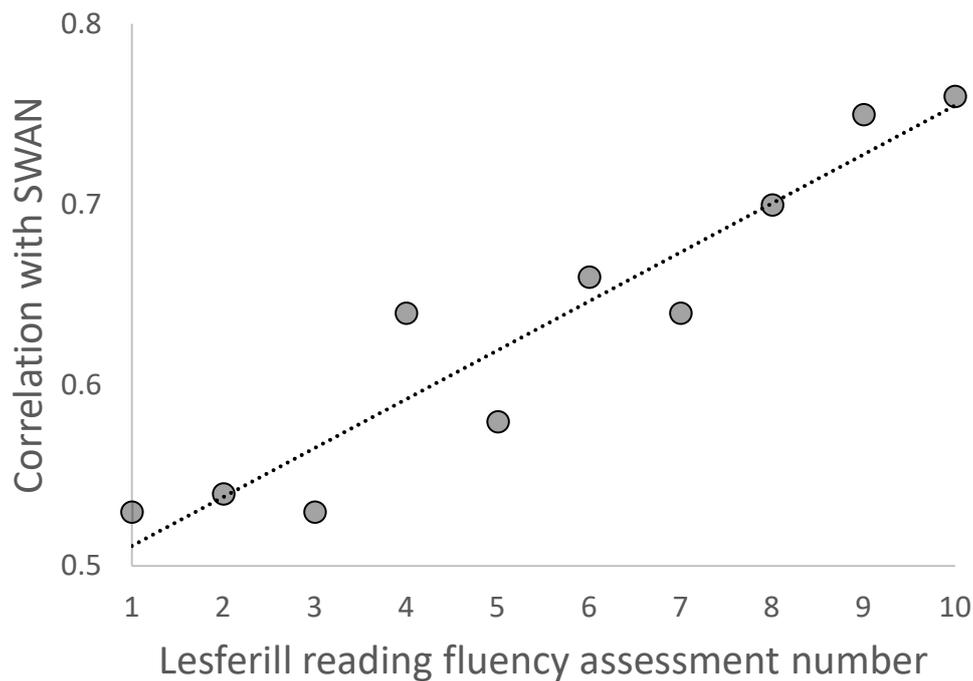


Figure 3. The correlation between SWAN and reading fluency increased linearly with age, from the beginning of 2<sup>nd</sup> grade to the beginning of 5<sup>th</sup> grade.

The association between IS-FORM/IS-PSEUDO and the two SWAN subscales (SWAN-Inattentive subscale items 1-9 and SWAN-Hyperactive/Impulsive subscale items 10-18, table 2) was explored. Multiple regression with Inattentive scores and Hyperactive/Impulsive scores as factors showed that the SWAN-Inattentive subscale (standardized  $\beta = 0.63, t = 2.38, p = 0.030$ ) but not the SWAN-Hyperactive/Impulsive subscale (standardized  $\beta = 0.13, t = 0.50, p = 0.625$ ) explained unique variability in mean IS-

FORM scores. Neither subscale explained *unique* variance in IS-PSEUDO reading (SWAN-Inattentive subscale: standardized  $\beta = 0.40$ ,  $t = 1.19$ ,  $p = 0.252$ ; SWAN-Hyperactive/Impulsive subscale: standardized  $\beta = 0.10$ ,  $t = 0.29$ ,  $p = 0.774$ ).



Figure 4. Correlation matrix for SWAN and 4<sup>th</sup> grade Icelandic National Exams in mathematics and the Icelandic language. Mathematics and language subscores: Maths 1: Arithmetic and operations; Maths 2: Numbers and number comprehension; Maths 3: Geometry; Language 1: Reading comprehension; Language 2: Language use. Upper triangle shows Pearson's  $r$  correlation coefficients, lower triangle shows scatterplots with linear fits and 95% confidence bands, and the diagonal shows univariate density plots. No correlations with SWAN were significant; all other correlation coefficients were significant (alpha level: .05).

SWAN was positively and significantly correlated with all Lesferill reading fluency tests (fluency 1-10) which were independently assessed ten times by teachers across the 2<sup>nd</sup>,

3<sup>rd</sup>, 4<sup>th</sup>, and 5<sup>th</sup> grade (figure 3). Interestingly, the correlation between SWAN and Lesferill reading fluency increased linearly with time, from fluency test 1 (administered at the end of 2<sup>nd</sup> grade) to fluency test 10 (administered at the beginning of 5<sup>th</sup> grade),  $r = 0.95, p < 0.001$ .

Unlike the clear association between SWAN and all reading measures, there were no significant associations between SWAN and any of the scores from the 4<sup>th</sup> grade Icelandic National Exams in mathematics and the Icelandic language (figure 4). When partialling out Language total and Math total scores, SWAN was still positively correlated with IS-FORM 1 ( $r_{\text{partial}} = 0.68, p = 0.005$ ) and IS-FORM 2 ( $r_{\text{partial}} = 0.57, p = 0.028$ ) but not IS-PSEUDO ( $r_{\text{partial}} = 0.32, p = 0.247$ ).

## Discussion

The current study provided the first test of three instruments in a sample of Icelandic children: IS-FORM (subtests IS-FORM 1 and 2), IS-PSEUDO, and the SWAN rating scale. We set out to estimate reliability and validity of the IS-FORM and IS-PSEUDO reading fluency tests, look at the reliability and factor structure of SWAN, and see if there were specific associations between reading and dimensions of ADHD-related behaviors captured by SWAN.

The results support that IS-FORM and IS-PSEUDO are reliable and valid instruments for assessing the reading fluency of 4<sup>th</sup> grade children. The tests were highly correlated with each other as well as with independent assessments of reading fluency. They were also related to children's interest in and experience with reading. While IS-FORM 1, IS-FORM 2, and IS-PSEUDO measure a common reading fluency construct, they also additionally seem to capture sub-measures of the reading of familiar words (IS-FORM 1 and partially IS-FORM 2)

and the reading of phonologically valid pseudowords (IS-PSEUDO and partially IS-FORM 2, where some uncommon word forms might be completely unfamiliar to children).

The SWAN rating scale had excellent reliability in our sample. Although some studies (see e.g. Arnett et al., 2013) report that SWAN consists of two components, unconstrained PCA with varimax rotation converged on a three-component structure. This could be in accordance with the categorization of ADHD by the DSM-V, where the diagnosis is now threefold (ADHD hyperactive, ADHD inattentive and ADHD combined, respectively; American Psychiatric Association, 2013). However, forcing a two-factor solution provided a factor structure that aligned well with the ADHD-Inattentive and ADHD-Hyperactive/Impulsive subscales of SWAN as previously found by e.g. Arnett et al. (2013) and Swanson et al. (2012).

SWAN was significantly and positively correlated with all reading measures in alignment with other research on the association between ADHD symptoms and diminished reading ability (e.g. Germanò et al., 2010; Willcutt & Pennington, 2000). SWAN scores were particularly related to the reading of real words, as opposed to pseudowords, and this did not seem to be explained by reading interest, reading experience, or gender differences. Poor reading ability showed signs of being more strongly associated with inattention rather than hyperactivity/impulsivity, again in alignment with previous studies (Willcutt & Pennington, 2000), at least when it comes to the reading of real words. Unlike the clear association between SWAN and all reading measures, there were no detectable associations between SWAN and Icelandic language or mathematics scores from the 4<sup>th</sup> grade Icelandic National Exams. The specific connection between SWAN and real-word reading is unlikely to be a reflection of general academic achievement.

Interestingly, the correlation between SWAN and reading fluency increased linearly with time, from explaining around 28% of the variability in reading fluency at the beginning

of 2<sup>nd</sup> grade to explaining around 58% of the variability in reading fluency at the beginning of 5<sup>th</sup> grade. This hints at ADHD-related symptoms and behavior hindering children from reaching their full reading fluency potential. This provides a possible route to intervention of reading problems. Further studies should assess whether early SWAN assessment can predict reading problems that emerge several years later.

Finally we note that all interpretation of data in this study should be taken with a grain of salt given the small sample size. The stability of the factor structure of the Icelandic translation of SWAN particularly needs further validation. More generally, larger-scale studies are needed where other variables, such as children's vocabulary (Gunnarsdóttir et al., 2004) and phonological processing abilities (Pind, 1998), are taken into account.

#### **Author Note**

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## Appendix

Nafn barns: \_\_\_\_\_

Fylgiskjal í rannsókninni:  
„Tengsl lestrarfærni og sjónskynjunar hjá 10 ára börnum“

Kennitala barns: \_\_\_\_\_

**Börn eiga misauðvelt með að stýra athygli sinni og hegðun og að halda aftur af sér þegar það á við. Fyrir hvert atriði í listanum hér fyrir neðan ertu beðin(n) um að meta hvernig barnið þitt er miðað við jafnaldra. Vinsamlega merktu við þann svarmöguleika sem best á við barnið síðastliðinn **mánuð**.**

	Langt fyrir neðan meðallag	Fyrir neðan meðallag	Rétt fyrir neðan meðallag	Í meðal-lagi	Rétt fyrir ofan meðallag	Fyrir ofan meðallag	Langt fyrir ofan meðallag
1. Hugar vel að smáatriðum og gerir sjaldan fljótfærnisleg mistök.							
2. Heldur athygli við verkefni eða í leik.							
3. Hlustar þegar talað er beint til hans/hennar.							
4. Fylgir fyrirmælum til enda og lýkur við gefin verkefni.							
5. Skipuleggur verkefni sín og athafnir.							
6. Tekst á við viðfangsefni sem krefjast þess að halda einbeitingu.							
7. Passar upp á hluti (týnir þeim ekki).							
8. Leiðir hjá sér truflandi áreiti.							
9. Man eftir því sem gera þarf dags daglega.							
10. Getur setið kyrr (hefur stjórn á hreyfingum handa eða fóta eða er ekki á iði).							
11. Er kyrr í sæti (í skólastofu eða við aðrar aðstæður þar sem ætlast er til að setið sé kyrr).							
12. Getur haldið aftur af sér þegar hann/hún má ekki hlaupa eða þrila einhvers staðar.							
13. Leikur sér hljóðlega (með hæfilegum hljóðstyrk).							
14. Róar sig niður (hefur stjórn á stanslausri virkni).							
15. Getur stillt sig um að tala of mikið þegar það á við.							
16. Hugsar sig um áður en svarar spurningum (gloprar ekki út úr sér svörum).							
17. Bíður þar til röðin kemur að honum/henni (bíður í röð og skiptist á).							
18. Kemst inn í samræður eða leiki án þess að ryðjast eða trufla aðra.							