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Children’s development of semantic verbal fluency during summer vacation versus during formal schooling

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ABSTRACT

Purpose: Children’s results on school-related achievements tests, such as aspects of math, reading and writing, have been shown to decline following a lengthy summer vacation. Few studies have investigated whether this also applies to vocabulary skills. The purpose of this study is to investigate how lexical organization and retrieval, assessed by a semantic verbal fluency (SVF) task, develops during a lengthy summer vacation versus formal schooling.

Method: Sixty-eight children with mean age of 7.9 (ranging from 6.5 to 9.1), were assessed pre- and post-summer vacation and post-fall semester using two SVF categories (Animals and Clothes). The number of words produced in both categories gave the total score.

Results: The result of the SVF tests decreased following summer vacation. The loss was recouped at the post-fall semester assessment, but no gains compared to initial testing were shown. Neither level of parental education, general language ability, non-verbal IQ, nor bilingualism explained the variance in development during the summer vacation or the fall semester.

Conclusions: Our findings indicate that a lengthy summer vacation causes a recess in the expected development of SVF ability and that this recess is recouped after a semester of formal schooling. The findings are in line with previous research indicating that summer vacation may have negative impact on the development of important scholastic abilities in children.

Introduction

When children enter school, the demands on language abilities increase and well-developed language skills are important for school success [1]. The current Swedish curriculum for mainstream education [2] places high demands on both oral and written language understanding, as well as language use in all subjects. The teaching should develop the children’s vocabulary; the meaning of words and how they relate to other words, and how to use words in different contexts. Furthermore, children should develop their ability to use their language skills to discuss, give presentations, express opinions, formulate, reason, motivate, debate, etc [3].

Vocabulary knowledge has a strong relationship with overall language proficiency. There is a strong correlation with vocabulary measurements and reading, listening, writing and grammar [4]. Different aspects of lexical competence can be assessed with a wide range of tasks, see for example [5]. One commonly used measurement for lexical-semantic ability is semantic verbal fluency (SVF) tasks [6]. In the present study we explore the effects of summer vacation compared to formal schooling on the development of SVF ability in school-aged children.

The Swedish school year

The Swedish school year has two semesters: fall and spring semester and a 9-10-week summer vacation from June to August [7]. The academic year is based on a tradition dating back to when the schools had to take into consideration the community’s agricultural needs (e.g., harvesting) [8], and hence not on research on what is most beneficial for the development of children attending school. Globally the summer vacation usually lasts between 4 (e.g., Singapore [9]) and 12 weeks (e.g., Greece [10]), placing Sweden’s 9-10-week summer vacation in the upper end of the time span.

At the time of the study attending school was mandatory from fall semester the year the child turns seven years old. Since then, the preparatory school year starting at the fall semester when the child turns six years old has become mandatory [11].

Research on the effects of a lengthy summer vacation

A review [12] of 39 studies, mainly conducted in the USA, between 1906 and 1994 investigating the effect of summer vacation on children’s development indicated that there is a
general decline in achievement scores over summer vacation but that different skills are affected differently. A meta-analysis of the 13 most recent studies in the review by Cooper et al. [12] showed that there is a more detrimental effect of summer vacation on mathematical skills than on language or reading skills. The summer loss was equal to about one-tenth of a standard deviation relative to spring test scores or about one month of teaching.

The review by Cooper et al. [12] also investigated possible moderating effects on summer loss. Among the possible moderating effects described in the literature on summer loss, we have selected those relevant to our study on lexical-semantic organization and retrieval measured with a SVF task. The possible moderating effect of intelligence is among the earliest and most frequently studied. However, there is no consistent pattern of influence of intelligence, as measured by traditional IQ measures, on the effect of summer vacation, at least when it comes to children with IQ scores within the normal range. Regarding socioeconomic status (SES), studies have employed different methods for estimating SES: parental income level, social class status, and level of parental education (LPE). No effect of SES is seen on math achievements; children from both middle and low SES background experience a loss. In reading and language, students from lower SES background demonstrate more losses while students with middle SES background either lose less or sometimes gain skills during the summer vacation according to Cooper et al. [12]. Gender and ethnicity have not been clearly shown to influence the adverse effects of summer vacation. When it comes to grade effect, older students experience larger negative effects of summer vacation than younger students [12].

The effect of summer vacation on language abilities
The results from studies investigating the effect of summer vacation on different aspects of language abilities (usually vocabulary, e.g. word meaning) are mixed [13–18]. The picture is thus inconclusive, but the results indicate that summer vacation might affect differently depending on SES, mono/bilingualism, and individual starting position and developmental trajectories.

Semantic verbal fluency
SVF is a task where the child is asked to name as many words as possible within a specified semantic category (such as Animals, Food or Clothes) usually with a time constraint (often 60 s) [19]. In research and clinical settings, the number of categories used to assess SVF ability often range from one to four. The most frequently used category for the SVF task is Animals [20]. In the present study, we used two categories: Animals and Clothes.

Several factors are considered to have an impact on SVF ability by authors with different theoretical perspectives, including intact lexical knowledge [21], retrieval of words [22,23], efficient search strategy [21], as well as executive functions such as inhibition [24], flexibility [25], working memory, and shifting [26]. Assessment of SVF can give us insight into the strength of links between elements of the lexical system [27].

Children’s performance on SVF tasks can be measured as a total score, i.e. number of within-category items (e.g. [28]), switching and clustering, i.e. distribution of items in subcategories (e.g. [29]), and how words are distributed within the time frame (e.g. [30]). In the present study, the focus is on total number of correct responses.

Influencing factors and development of SVF
The ability to list words within a category has been studied on children from the age of 3, e.g. [31]. A number of studies in different languages, e.g. Australian-English [32], Swedish [33], Hebrew [34], Spanish [25], Italian [35] and Dutch [30], have shown that SVF total score gradually improves with age until at least 12–13 years, and possibly continues to develop into early adulthood [33]. There is a positive effect of education on the performance on VF tasks in an adult population e.g. [20,36–38] but to our knowledge there are no studies investigating the developmental trajectory of SVF during the school year to see if an effect of schooling is visible after a short period such as a semester.

Other than age, the LPE, but not sex, has been shown to affect the performance on SVF tasks. A higher level of LPE is associated with higher SVF scores [30,39]. Vocabulary size is positively correlated with higher results on SVF tasks [40]. Children perform better on categories commonly used in SVF tasks, such as Animals or Food, than on uncommon categories, such as Clothes [41].

The relationship between SVF and performance on verbal and non-verbal intelligence tests is unclear. Ardila et al. [42] found a correlation between SVF and verbal IQ as well as full-scale IQ, whereas Ardila et al. [43] only found a low correlation with a subset of WAIS subtests, particularly Digits, Arithmetic, and Information. Pastor-Cerezuela et al. [44] found no significant correlation between neither SVF and verbal IQ nor non-verbal IQ in typically developing children. Several studies have shown that bilinguals produce fewer words during SVF tasks than monolinguals do [45–48] and three proposed explanations to the bilingual disadvantage are (1) interference between languages due to inhibition effects, (2) a slower word retrieval, due to weaker links in the lexicon caused by words being less often used in each language, but without interference and/or (3) reduced vocabulary within each language [45]. Language proficiency also affects the performance in bilinguals, and they produce fewer words in their non-dominant compared to their dominant language [49].

The above-mentioned factors influencing SVF ability may all be involved when it comes to individuals with poor results on SVF tasks. SVF is frequently assessed in clinical settings and research. The task is easily administered and can detect deficits due to a range of clinical conditions [50]. Impaired SVF has been shown in a series of developmental as well as acquired conditions, e.g. Developmental Language Disorder [51], Down Syndrome [52], word finding difficulties [53], Schizophrenia [54], HIV [55], traumatic brain injury [56], and dementia of the Alzheimer’s type [57].
In sum, previous studies have shown that SVF total score increases steadily during childhood and is enhanced by formal schooling. There is a body of research indicating that a lengthy summer vacation may have negative impact on some aspects of development in children, and the effect of summer vacation may differ due to individual background factors. For this reason, it is interesting to investigate the effect of summer vacation versus formal schooling on the result on SVF tasks in school-aged children, as well as possible background factors influencing the development.

Aims

Our first aim is to investigate the development of SVF total score during summer vacation versus during formal schooling in children attending preparatory school and year one in Swedish mainstream school.

Our second aim is to examine whether the development during summer vacation and formal schooling is influenced by general language ability assessed by CELF-4 Core Language subtests [58] (CELF-4), non-verbal IQ assessed by Raven’s CPM [59] (RCPM), bilingualism (BL), or LPE.

Method

Participants

The current study is part of a comprehensive study measuring the efficacy of Speech-Language Therapist-led in-service training for teachers, on children’s language development. Participants in the present study were children from the classes which served as waiting controls during the time of the present study. In the waiting control group all children, a total of 186 children in 7 classes, were invited to participate. Eighty-three children accepted, of whom 14 dropped out due to moving during the time of the study (8), influence of by test administrator uncontrolled visual stimuli in the test room (3), difficulties participating in the assessments (1), and being newly arrived in Sweden and not yet speaking Swedish (1). One participant completed the assessments but was not included in the analysis due to being an influential outlier. Hence the participants of the study were 68 children attending mainstream education in three schools in the same municipality in southern Sweden.

The participating schools received written information about the study to distribute together with oral information to the parents of all children in the preparatory class and grade one. Informed consent was required in accordance with ethical guidelines. The participating schools also distributed and collected letters containing a questionnaire on LPE, language exposure and use, and information about former or current speech-language therapy and/or special education services for the child.

Description of the participating children

Mean age of the children was 7.9, ranging from 6.5 to 9.1. Ten children were in the preparatory class at first assessment point and 58 were in first grade. Thirty-six participants were girls and 32 were boys. Information on LPE, speech-language therapy and/or special education services, and BL was assessed by a written parental questionnaire. Sixteen of the 68 participating children’s parents did not complete the entire parental questionnaire. LPE was assessed using a 3-point rating scale (1 = mandatory schooling (equals 9 years of schooling in Sweden), 2 = high school (equals 12 years of schooling in Sweden) or 3 = university level). The highest level of completed parental education, in accordance with Hurks et al. [30], was chosen for each child: 15.4% elementary school, 57.7% high school and 26.9% university (n = 52). Of those 52 children where the parents completed the questionnaire, 12.1% had previous or current Speech and Language Therapist service (n = 7: 2 speech, 2 language, 1 hearing impairment, 1 ADHD and autism, 1 unknown) and 10.7% had previous or current special education service (n = 6: 1 language, 1 ADHD/autism, 1 visual impairment, 1 newly arrived in Sweden, 1 shy, 1 unknown). Of these children, two had both Speech and Language Therapist service and special education services. Seventy-two percent were bilinguals, as defined by Grosjean [60] as individuals using two or more languages in everyday life, and 28% monolinguals according to parental report which was completed with teacher report on language use (n = 68).

General language ability standard scores of the participating children, as measured by CELF-4 Core Language score [61], ranged from 40 to 114, with a mean of 67.54, SD 20.7. Non-verbal IQ standard scores, as measured by Raven’s CPM [59], ranged from <60 to 135 with a mean of 88, SD 19.5. The expected results on both instruments is a mean of 100 and SD of 15. Hence, the participating children on average scored below age expectancies on both instruments. This is in line with previous research on results on CELF-4 for children from lower SES background and who are bilingual [62]. The Swedish norms for CELF-4 are based on monolingual children without hearing, visual, or developmental difficulties and with an under-representation of parents with a lower level of education [58]. The current sample is unselected in terms of this and in Sweden, children with disabilities are typically integrated within the mainstream setting. Based on this, a lower result on CELF-4 for this sample is not unexpected. When using Raven’s CPM on children for whom the test language is their second language, have a language disorder, or are from a diverse cultural group the test results compared to the normative information should be interpreted with caution [59].

The project was approved by the Regional Ethical Review Board in Lund (2016/8).

Demography of the participating municipality

The participating municipality is characterized by a higher level of children with foreign background (43%) (defined as born in a country other than Sweden or with two parents born in a country other than Sweden) than the national average (25%) and a lower level of parents with tertiary education (45%) compared to the average in Sweden (58%) [63].
Procedure

The children were assessed at three times: before summer vacation (T1), after summer vacation (T2), and by the end of the fall semester (T3). T1 took place in May, on average 2.6 weeks before summer vacation. T2 took place in August/September, on average 1 week after summer vacation, and T3 took place in November/December. The average number of weeks between T1 and T2 (summer vacation) was 13.4 and included some allocated school time both before and after the nine-week long summer vacation. Average number of weeks between T2 and T3 (fall semester) was 13.8. All tests were administered individually at the schools during school-hours by five certified Speech Language Therapists (SLTs) and two well-trained final year SLT students. The whole group of test administrators were trained by a senior researcher in the research group and were provided with written instructions for all assessment tasks in order to ensure procedural fidelity.

Instruments

Raven’s Colored Progressive Matrices (RCPM). During T1 the Raven’s Colored Progressive Matrices Test (RCPM) [59] was administered to assess the non-verbal IQ of the children. The RCPM consists of 36 elements with increasing difficulty where the child is required to select the missing piece among 6 elements to complete a pattern. RCPM gives an estimation of the non-verbal component of Spearman’s g-factor [64]. RCPM was administered and scored according to the test manual [59].

Clinical Evaluation of Language Fundamentals 4th edition (CELF-4). Four subtests of the Clinical Evaluation of Language Fundamentals—Fourth Edition (CELF-4)[61], Swedish adaptation [58] were administered at T1 to assess the general language ability of the children. The four subtests together give the Core Language Score and consist of Concepts and Following Directions, Word Structure, Recalling Sentences, and Formulated Sentences. The CELF-4 Core Language subtests were administered and scored according to the test manual [58]. One participant did not complete this measure.

Semantic verbal fluency task. The chosen categories for the SVF task were Animals and Clothes. The participants were asked to say as many Animals and Clothes, respectively, as possible within one minute. Included in the instructions to the participants were two examples from each category.

The SVF task took approximately 5 min to complete and the categories, Animals and Clothes, were administered in the same order for all the participating children. Responses were audio recorded using the mobile application RecUp, Irradiated Software, LLC and when possible also transcribed orthographically in real-time.

Scoring of SVF. The responses on the SVF task were transcribed from the audio recordings and orthographic transcriptions made during the testing, entered into a Microsoft Excel® spreadsheet, and scored by the first author. Scoring was modified from Chami et al. [32]. Total score was calculated as the number of words produced within the two categories (Animals or Clothes) minus rule violations and repetitions. The words used as examples were given points if the child produced them.

Rule violations included mispronounced words, such as bamboon instead of baboon. Mispronounced words due to phonological errors, such as systematic substitutions of specific speech sounds, were approved. Rule violations also included words not belonging to the specific category (e.g. hair for the Clothes category). Only words in Swedish were approved.

The children did not receive points for repetitions of words already mentioned. Repetitions included both exact and partial repetitions of previously mentioned responses as well as repetitions with additional information which did not suggest a new item (e.g. elephant/small elephant, jacket/warm jacket).

The Animal fluency task: General subcategories within the category, such as bird and fish, as well as specific examples, such as owl and piranha, were counted as correct responses. Proper terms for female/male adult and offspring (e.g. pig, sow, and piglet) were all approved. Extinct (e.g. dinosaur), but not fantasy (e.g. unicorn), animals were approved.

The Clothes fluency task: General subcategories within the category such as winter clothes or party clothes were not approved. Subcategories, such as shirts, as well as specific examples, such as sweater and t-shirt, were approved. Commonly used slang words, such as undies for underwear, were approved. All types of footwear (e.g. sandals and boots) were approved, but not accessories (e.g. bag and necklace).

Inter-rater reliability of SVF. A random selection of 10% of the material, was transcribed, entered into a Microsoft Excel® spreadsheet and scored by the second author and used for inter-rater reliability. Inter-rater reliability for scoring was calculated using Cohen’s Kappa (Cohen’s κ). κ = 0.904 for the two categories Animals and Clothes which is labeled ‘Almost Perfect’ by Landis & Koch [65].

Data analysis

All statistical analyses were performed using IBM SPSS Statistics 25 for Windows. All assumptions relevant to the calculations were checked prior to performing any statistical analysis. A one-way repeated measures ANOVA with Time (T1, T2, and T3) as a within-group factor was conducted to investigate the development of SVF total score during summer vacation (T1 to T2) versus formal schooling (T2 to T3). Assumptions on continuous as well as normally distributed dependent variable, independent variable consisting of related groups, and sphericity were met. One case was identified as a significant outlier and was excluded from all analyses. Bonferroni correction was used for post-hoc analysis to adjust for multiple comparisons.

Effect size reported as ηp² is interpreted against Cohen’s [66,67] benchmarks 0.0099 = small, 0.0588 = medium, and 0.1379 = large effect size. In order to estimate and describe
the effect of summer vacation a standardized mean difference, or $d$-index, [66], was calculated by dividing the difference between the sample’s average achievement score at T1 and T2 by the average of the two associated standard deviations as described in Cooper et al. [12]. The same calculation was conducted for the change between T2 to T3 to obtain an effect size for the effect of formal schooling. This was made to express the change in scores relative to the sample’s performance at previous assessment point. A $d$ index of $+.05$ means that the average achievement score in the sample is one-quarter standard deviation higher than the average achievement score at the previous assessment point [12]. This effect size is interpreted against Cohen’s [66] benchmarks 0.2=small, 0.5=medium, and 0.8=large effect size.

Two multiple linear regressions were calculated to predict development of SVF total score based on LPE, BL, CELF-4 core index score (CELF-4), and standard score on Raven’s CPM (RCPM) during summer vacation (T1 to T2) and formal schooling (T2 to T3), respectively. In the multiple linear regressions, the change in SVF total score was recalculated into a percentage of the previous score to compensate for differences in initial scores, i.e., a five-point drop change makes a greater difference if the initial score is 10 (-50%) than 30 (-17%). Both the model for development during summer vacation and fall semester met the assumptions on linearity relationships between predictors and outcome, multicollinearity, normality of outcome variable, standardized residuals and Cook’s distance, but no predictors had a correlation higher than 0.3, indicating that the models were not fit for explaining the variance.

The alpha level was set at 0.05 for all dependent variables.

Results
Evaluating the development of SVF total score during summer vacation versus during formal schooling

The result of the one-way repeated measures ANOVA showed that there was a significant effect of time on the result on mean SVF total score, Wilks’ Lambda = 0.785, $F(2, 66)$=9.026, $p = .001$. The one-way repeated measures ANOVA compared the mean SVF total score at T1, T2, and T3, see Table 1 for mean and SD of SVF total score for the participants at T1, T2, and T3. There was a significant effect of time on the mean SVF total score of the participants ($F(2,134)$=8.83, $p = .001$, $\eta^2$=.116) which equals a medium effect size interpreted against Cohen’s [66,67] benchmarks.

Bonferroni post hoc tests showed that participants had a significantly lower score at T2 compared to T1 ($p = .04$) and significantly higher score at T3 compared to T2 ($p = .001$).

However, there was not a significant difference between T1 and T3 ($p = .355$). This indicates that the losses during summer vacation had been recouped during the fall semester. No statistically significant growth in total score can thus be seen during this time.

On average the decrease in scores during summer vacation is $-1.55$ words, SD $= 5.02$ (range $= -14$ words to 8 words), $d = -.273$. During the fall semester, the average gain is $2.5$ words, SD $= 4.85$ (range $= -12$ points to 13 points), $d = .465$, during formal schooling. The effect size for the change both during summer vacation and formal schooling is considered a small effect size interpreted against Cohen’s [66] benchmarks.

In conclusion, we see a decline in scores during the summer vacation which equals about 0.27 SD compared to the spring score (T1). This loss is recouped when measuring after on average 13.8 weeks of formal schooling, but no significant gains compared to the spring scores (T1) are seen at this point (T3).

Evaluating the influence of background factors on the development of SVF during summer vacation and formal schooling

Multiple linear regression was calculated to evaluate the influence of background factors on the development of SVF total score during summer vacation. The change during summer vacation was calculated as percentage compared to T1 SVF total score, e.g. a three-point drop during summer vacation for a participant scoring 23 points at T1 equals a 13% setback. Predictors were LPE, BL, CELF-4 Language Core score (CELF-4), and standard score on Raven’s CPM (RCPM). The regression equation was not significant ($F(4,46)$=0.541, $p = .707$) with an $R^2$ of 0.045. Neither LPE, BL, CELF-4 nor RCPM were significant predictors of development of SVF total score during summer vacation, see Table 2.

The same calculation was run for the difference, calculated in percentage of T2 SVF total score, in scores between

| Table 1. Mean and SD of SVF total score for the participants at T1 (before summer vacation), T2 (after summer vacation), and T3 (end of fall semester). |
|-----------------|-----------------|-----------------|
|                 | T1              | T2              | T3              |
| Mean            | 20.21           | 18.66           | 21.16           |
| SD              | 5.93            | 5.44            | 5.32            |

| Table 2. Unstandardized beta ($\beta$), the standard error for the unstandardized beta (SE $\beta$), the standardized beta ($\beta_s$), the t test statistic ($t$), and the probability value ($p$) from the multiple linear regressions for the influence of the background factors: level of parental education, bilingualism, CELF-4 Language Core score, and standard score on Ravens CPM on the participants’ development of SVF total score during summer vacation and formal schooling, respectively. |
|-----------------|-----------------|-----------------|-----------------|-----------------|
|                 | Summer vacation | Fall semester  |
| Level of parental education (LPE) | 52 0.022 0.057 0.058 0.378 .707 | 52 0.016 0.068 0.036 0.239 .812 |
| Bilingualism (BL) | 68 0.021 0.102 0.039 0.204 .839 | 68 0.015 0.120 0.243 1.297 .201 |
| CELF-4 Language Core score (CELF-4) | 67 0.001 0.003 0.119 0.521 .605 | 67 0.003 0.003 0.243 1.035 .306 |
| Standard score on Raven’s CPM (RCPM) | 68 0.001 0.002 0.106 0.559 .579 | 68 0.004 0.003 0.256 1.366 .179 |
T2 and T3. The regression equation was not significant \((F(4,46)=0.797, p = .533)\), with an \(R^2\) of 0.065. Neither LPE, BL, CELF-4, nor RCPM were significant predictors of development of SVF total score during formal schooling, see Table 2.

In conclusion, the variance we see in development of SVF total score does not seem to be explained by the LPE, BL, general language ability, or non-verbal IQ during neither summer vacation nor formal schooling.

**Summary of results**

- There is a decrease of on average 1.55 points, or 0.27 SD, on SVF total score following the summer vacation.
- The decrease is recouped following fall semester, but no statistically significant additional gains are seen during the fall semester compared to before the summer vacation.
- The variance in development during summer vacation and formal schooling cannot be explained by LPE, BL, general language ability or non-verbal IQ.

**Discussion**

In the present study, we investigated the effects of summer vacation compared to formal schooling on the development of SVF ability, and whether the development was affected by LPE, BL, general language ability or non-verbal IQ. A lengthy summer vacation can have negative impact on children's development, but different skills are affected differently, and SES may play a role in whether a child makes gains or losses during summer vacation [12]. Many studies in different languages have shown that there is a continuous development of SVF total score during childhood and adolescence, e.g. Australian-English [32], Swedish [33], Hebrew [34], Spanish [25], Italian [35] and Dutch [30]. Here we show a setback in the expected development during summer vacation that is recouped during the fall semester. This could mean that the annual gains that are seen in longitudinal SVF studies, are mostly acquired during the spring semester.

Previous studies have shown that the achievement on SVF tasks can be affected positively by a higher LPE and negatively by BL. Lower SES, e.g. LPE, can affect the development of other skills during summer vacation negatively and summer vacation could be more detrimental for bilingual children who do not speak the language of school instruction at home [12]. In this study, we see a decline in SVF scores following the summer vacation, but this is not associated with LPE or BL and neither with general language ability nor non-verbal IQ. We do however see a variance in change both during summer vacation and the fall semester. During the summer vacation, the change in scores ranges from \(-14\) points to 8 points and during the fall semester the range is \(-12\) points to 13 points. Hence, not all children experience a setback during summer vacation and not all children experience a gain during the fall semester. But this variance does not seem to be explained by LPE, BL, general language ability, and non-verbal IQ. This result indicates that there are either unknown factors accounting for the difference in variance or that the development is not affected by background factors.

SVF requires both executive functioning and lexical-semantic skills. The reason why we see a decline in SVF scores following summer vacation is unknown. Our results indicate that the effect of schooling on SVF scores seen in an adult population, where a higher level of education is associated with higher SVF total scores, e.g. [20,36–38] seems to be evident also in the early school years. This effect seems to be visible even after as short a period as a summer vacation and fall semester. School absence during summer vacation decreases SVF abilities whereas formal schooling during the fall semester increases the verbal fluency. Consequently, activities in school seem to promote the development of SVF. In the Swedish curriculum for the lower grades categorizing and naming is a common activity in multiple school subjects. For example, children are required to categorize and name plants, animals and body parts in the earlier grades [2]. Thus, structural work with organization of the vocabulary is a frequent activity in the classroom. These kinds of structural language promoting activities could be assumed to be carried out to a much lesser degree by caregivers during the summer vacation, which could be an explanation of the decline we see.

**Discussions regarding the lengthy summer vacations in Sweden**

The possible negative effects of lengthy school holidays have been discussed since the beginning of the 19th century in Sweden [68] but most of the research on how it might affect children’s development stems from the USA [69]. There is an ongoing debate regarding the length of summer vacation, the amount of instructional time, and mandatory vacation school. There have also been numerous proposals to shorten the summer vacation, both locally and nationally in Sweden but all have so far been rejected. Arguments for changing the school year include declining results by Swedish students in international assessments such as PISA and a lower amount of allocated school time in Sweden compared to other European countries. But also, ineffective use of school buildings and difficulties combining a lengthy summer vacation for children with a much shorter summer vacation for parents are mentioned as arguments.

Although knowledge of the phenomenon labeled “summer loss” is quite extensive at this point, the way to most effectively attack this problem remains unsolved. In Sweden discussions regarding mandatory school for disadvantaged students during summer vacation and other breaks have been present since at least early 19th century [68]. Other than summer school, two frequently proposed solutions to prevent summer loss are extension of the school year with the addition of more instructional time or modification of the school calendar where a lengthy summer vacation is replaced by shorter breaks throughout the school year [70]. The effect of these approaches has
been evaluated to some extent, e.g. summer school [71], extension of the school year [72], and modification of the school calendar [73]. However, a direct comparison of which approach is more efficient for promoting the development of both academic achievement in different subjects, and non-achievement measures, such as students’ motivation and well-being, has not been made. Cooper et al. argue that “districts seeking effective remedial programs as well as solutions to summer learning loss should consider all possible interventions” [73].

Limitations
As with many other studies regarding the effect of summer vacation our time between pre- and post-summer vacation assessments includes some allocated school time. Assessment points closer to the beginning and end of the summer vacation could show larger effect sizes. In order to more accurately compare the “true effect” of summer vacation versus formal schooling, T1 and T2 would ideally be conducted immediately adjacent to the beginning and end of the nine-week summer vacation, and T3 would be conducted nine weeks into the fall semester (which in total is 18 weeks in Sweden).

Our study only includes children in the lower grades and other studies have indicated that the effect of summer vacation might differ depending on grade level. Our sample has a higher proportion of bilingual children and children from low SES background, and lower results on non-verbal IQ than expected in an average Swedish sample of children. With an increased sample size and hence larger diversity, it is possible that other tendencies would emerge when it comes to development both during summer vacation and during schooling.

Future research
Future studies should consider the limitations stated earlier. By only measuring before and after summer vacation and after fall semester we don’t get the full picture of the developmental trajectories during a full year. A future study adding more assessment points could investigate the developmental trajectories of SVF ability not just once yearly, as has been done previously in longitudinal studies, but during the school year. This could give us more insight into how this skill is affected by formal schooling as well as both shorter and longer school breaks.

SVF is one aspect of lexical-semantic competence. Future studies should investigate other vocabulary measurements, as well as other language abilities, to further investigate how different language skills develop during summer vacation in comparison to during formal schooling.

If, and then in what way, teachers should tackle the matter of summer loss has not been the focus of the present study. Neither has the question regarding if there are ways to speed up the recoup during the fall semester, which could be the focus of future studies.

Conclusion and clinical implications
SVF is thought to develop consistently during childhood and tasks measuring the ability are frequently used in both clinical settings and research. Here we show that the development differs during summer vacation, where we see a setback, compared to during fall semester, where we see a recoup of the loss but no further growth. The average setback corresponds to 1.55 points or 0.27 SD relative to the participants’ spring scores. The results should be considered when conducting SVF tasks on children directly following a lengthy summer vacation.

These results also add to the understanding of the development of SVF during childhood by indicating that formal schooling has a direct effect on the development. This has consequences for the interpretation of SVF scores of children with high levels of school absence. For these children, a low score could be the result of school absence, rather than indicating the presence of a developmental or acquired condition impairing the SVF ability.

This study adds to the body of research indicating that a lengthy summer vacation may challenge the development of certain skills. Whether the decline we see during summer vacation affects the children’s academic participation and results was not investigated in this study. Further studies are needed to see if there is a functional impact on e.g. word retrieval ability during school tasks following a lengthy summer vacation.

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