THE IMPACT OF SYNTACTIC AND LEXICAL TRAININGS ON CAPITALIZATION OF NOUNS IN GERMAN IN GRADE FIVE

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Abstract
Many orthographies include syntactic markers not represented in phonology. In general, to correctly use these syntactic markers, learners have to analyze and understand the syntactic context of the word to be written. Capitalization of nouns, a syntactic marker in German, involves marking heads of noun phrases and is challenging for learners. The aim of this intervention study was to evaluate the effects of syntactic and lexical based trainings on capitalization of nouns. 114 Luxembourgish fifth-graders were assigned to two syntactic groups, a lexical group and a passive control group. The syntactic groups focused on two variants of training syntactic structures within the noun phrase. The lexical group focused on lexical characteristics of nouns and the control group received reading input. The posttest results show that the students in the intervention groups profited from the syntactic-based training. The follow-up test shows that the intervention was sustainable, as the improvement remains stable. The study indicates that a greater focus on syntactic structures can effectively enhance the use of syntactic markers of capitalizations. Although this approach is initially harder to acquire, it covers all cases of capitalization.

Keywords: syntactic marker, capitalization of nouns, German, competing didactic approaches, intervention study

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1. INTRODUCTION

Writing systems do not only encode phonological, orthographic and morphological but also syntactic information. The spelling of syntactic information is difficult as the writer needs to consider not only the word level, but the context of the entire sentence. Capitalization of nouns is a syntactic marker in German, prone to errors until the end of secondary school (Betzel, 2015).

1.1 Syntactic markers

Syntactic markers exist in many orthographies and are orthographic elements which occur if a syntactic condition is met (Funke, to appear). These markers are not or not systematically represented in phonology. Many syntactic markers represent inflection. Orthographic syntactic markers are frequent in French, for instance. An example is the inflection morpheme 's' that represents the plural agreement on nouns and adjectives on and is marked on every word within the nominal group (e.g. *la fleur jaune* 'the yellow flower'*/ le**s** fleur**s** jaune**s*** 'the yellow flowers'). In English, the apostrophe is a syntactic marker, as it represents the possessive construction (e.g. the artist's/the artists'). In English and French, syntactic markers represent inflectional information. In German, the systematic marking of nouns with an initial capital letter (Eisenberg, 2006; Maas, 1992) is considered as a syntactic marker, although the initial capital letter does not represent an inflection morpheme but a syntactic principle that highlights each head of a noun phrase (Bredel, 2006a). Whereas in English, morphology illustrates the change of word classes, in German, orthography indicates the word class 'noun' by an initial capital letter. Hence, every word can become a noun without any morphological modification: for instance, a verb and a nominalized verb (e.g. *Ich hörte sein Singen* 'I heard his *singing*' vs. *Ich hörte ihn singen* 'I heard him *singing*'). Even if the syntactic markers differ linguistically across languages, they share similarities regarding its processing in reading and writing: On the one hand, orthographic syntactic markers are assumed to facilitate the reading process by the visual structuring of the sentence or by reducing the semantic ambiguity (Berninger, Abbott, Abbott, Graham, & Richards, 2002; Bock, 1989; Müller, 2016). On the other hand, if the syntactic information is not present in phonology, the spelling of the syntactic markers poses difficulties for the writer regardless of the language (for German: Betzel, 2015; for English: Nunes, Bryant, & Olsson, 2009; for French: Totereau, Brissaud, Reilhac, & Bosse, 2013). The writer cannot rely on phoneme-grapheme correspondences and needs to consider the syntactic structure in order to mark the syntactic information. To achieve this task, teaching these syntactic markers by focusing on the underlying syntactic structures has found to be beneficial for children's spelling progress in English (Bryant & Nunes, 2003), French (Bîlici, Ugen, Fayol, & Weth, 2018; Totereau et al., 2013) and German (Funke, Wieland, Schönenberg, & Melzer, 2013; Wahl, Rautenberg, & Helms, 2017). However, the syntactic approach derived from this insight has not

found wide-spread use in regular classroom teaching in German-speaking countries. Here, teaching focuses mainly on single words and word classes that are presented without any syntactic context. Based on school reality on the one hand and research in German didactic on the other hand, an opposition between a 'lexical approach' and a 'syntactic approach' can be discerned.

1.2 Lexical and syntactic perspectives on a noun

Before contrasting the two different didactic approaches to teach capitalization of nouns, the concept of a noun in German and the rationale of its marker need to be explained further, as they have been theorized linguistically from two different perspectives. The *lexical perspective* relates the capitalization of nouns to the word class 'noun'. Typical nouns combine semantic, morphological, and syntactic features. Semantically, nouns represent concrete or abstract conditions (e.g. objects, activities, relations, properties). Morphologically, nouns are fixed in gender and inflect according to number and case. Syntactically, nouns are polyfunctional in the sense that a noun can assume any function in the sentence, except the predicate (Bredel, 2006b; Fuhrhop, 2015; Nerius, 2007). These features allow identifying a typical noun. However, the identification of a noun—and, accordingly, its capitalization—are complicated by the fact that these features are not always present. For instance, the semantic feature does not apply to nominalizations and words from different word classes (verbs, adjectives) used as a noun (e.g. *Die Kinder spielen im Garten.* 'The kids *play* in the garden.' *Das Spielen scheint anstrengend zu sein.* 'The *playing* seems to be exhausting.'). Furthermore, the plural form is not always applicable, such as in mass nouns (*der Zucker*, 'the sugar'). *The syntactic perspective* relates capitalization to the head of the noun phrase. As such, a noun functions as specific syntactic category (Maas, 1992; Eisenberg, 1981, 2006). This characteristic applies to all nouns, independent of their semantic or morphological properties. From this perspective, capitalization is a regular syntactic marker highlighting the noun that indicates the end of the noun phrase (the head of the noun phrase), even if it is extended to the left. Accordingly, the head of the noun phrase is marked with an initial capital letter (Eisenberg, 1981; Maas, 1992). On a more general level, the syntactic marker represents the agreement structure of the noun phrase (Funke, 2017).

1.3 Different didactic approaches to teach capitalization of nouns

Based on these different linguistic perspectives, two didactic approaches to teaching capitalization of nouns exist, i.e. the lexical and the syntactic approach, the former being predominant in German classes today. In almost all textbooks, capitalization is based on the lexical perspective of capitalization and thus linked to the word class 'noun'. The didactic implementation of the so-called *lexical approach* focuses on contrasting different word classes—nouns, adjectives, and verbs—postulating that

nouns have to be capitalized whereas adjectives and verbs do not. The focus is, first, on a specific type of nouns, namely concrete nouns, and semantic properties are given 'names for things that can be touched or seen are capitalized', e.g. people, animals or objects (Bredel, 2010; Günther & Gaebert, 2011). Abstract nouns and nominalizations (of verbs and adjectives) are the focus later in the curriculum and are introduced as 'words that are used like nouns' (Bredel, 2010; Günther & Gaebert, 2011), as the semantic properties do not fit nominalizations. Capitalization is also taught by means of a strategy called 'determinant test' (*Artikelprobe*). Initially conceptualized as a syntactic strategy that allows identifying the words that need to be capitalized, it is often applied as a simple signal word strategy, i.e. if a determinant is present, the following word is considered a noun (Betzel, 2015; Günther & Gaebert, 2011). The lexical approach has often been criticized as its implementation does not include the entirety of the above-mentioned semantic, morphological and syntactic features of nouns, but rather limits its focus to the semantic features. Even though this limitation on semantics seems easier at the beginning of grammar acquisition, the children do not grasp the complexity of the category 'noun' and are confronted with many exceptions at a later stage. Various studies indicate that students' performance in capitalization might depend on the lexical-semantic properties (concrete or abstract nouns and nominalizations) of a noun for L1 (Betzel, 2015; Günther & Nünke, 2005; Scheele, 2006; Wahl et al., 2017) and L2 learners instructed with the same lexical approach as students in Germany (Bîlici, Ugen, & Weth, submitted). Abstract nouns and nominalizations are more prone to error than concrete nouns (Scheele, 2006; Betzel, 2015). Furthermore, the performance in capitalizations is influenced by the noun's position in the noun phrase. The distance between article and noun also seems to influence the spelling process (Betzel, 2015). Nouns preceded by a determinant seem easier to capitalize than nouns preceded by an adjective and a determinant. The latter seem easier to capitalize than nouns preceded only by an adjective. Bare nouns (not preceded by determinant and/or adjective) are the most difficult to spell correctly with respect to capitalization (Betzel, 2015; Günther, 2007; Scheele, 2006). Semantic properties as well as syntactic context still influence the spelling performance at grade 7 (Betzel, 2015).

To reduce these difficulties, an alternative didactic approach focusing on the noun in the syntactic context was developed (Funke, 2017; Günther & Nünke, 2005; Röber-Siekmeyer, 1999). The didactic implementation of the *syntactic approach* is characterized by the identification of noun phrases and their extension with adjectives, called test of extension (*Erweiterungsprobe*). The latter involves checking whether there is an agreement within the noun phrase in order to recognize the head of the noun phrase as the last element in this word group. An extension with two or more adjectives is most convenient, as adjectives within one noun phrase are inflected in parallel (e.g. *das schöne, saftige Grün* 'the beautiful, juicy *green*'). If the adjective refers to a noun, the adjective must be inflected (e.g. *der schön**e**, dick**e** Baum* 'the beautiful, big *tree'*). In the case of the adjective referring to a non-noun, the adjective remains without inflection (e.g. *die Bäume sind groß* 'The trees are

big'). Thus, in order to grasp the syntactic marker of capitalization, training to recognize the noun phrase and the structural relations between words within the phrase matters (Bredel, 2006b; Funke, 2005).

Several studies investigated whether children in German schools benefit from the syntactic approach to grasp capitalization and improve their spelling performance. A qualitative study conducted by Günther & Nünke (2005) implemented a training (16 double lessons) according to the syntactic approach in a second-grade class. After the lessons, an improvement in marking capitalization for nominalized verbs and adjectives in a text dictation was observed. A small-scale intervention study with 53 fifth-graders conducted by Gaebert (2012) showed the effect of a syntactic training (18 double lessons) on weak and strong spellers compared to a control group. The students improved their spelling of capitalization after the training and outperformed the control group. Overall, strong spellers benefited more from the training than weak spellers. An intervention study by Funke et al. (2013) implemented experimental classes in which students explored syntactic structures, and analyzed the effects on literacy-related achievements. No instructional effects on spelling and reading comprehension were observed. In addition, the instructional effect on capitalization was not very marked but occurred over a wide range of achievement levels and was observed even five weeks after the training. By exploring syntactic category contrasts, students learned to identify syntactic categories and transfer this insight to capitalization. Wahl et al. (2017) conducted an intervention study with 618 second-grade children from Germany to compare the two didactic approaches (syntactic vs. lexical-semantic approach). Effects regarding the capitalization of nouns were tested with a production (spelling) and a recognition test. The participants were divided into three different groups, two groups were instructed according to the syntactic approach and one according to the lexical approach. The lessons were given by the teachers to the entire class. Although the syntactic groups did not yield better results than the lexical group, they indicate that the syntactic groups' spelling performance in terms of capitalization was comparable to the performance of the lexical group. The capitalization of concrete and abstract nouns improved in all three groups. As no clear effects in spelling between the lexical and syntactic groups could be identified and as these results were interpreted as a consequence of teacher effects, an experimental intervention study investigated the effect of a controlled grammatical training in smaller leaner groups on the spelling of capitalization of nouns in German (Bîlici et al., submitted). The study was conducted in Luxembourg with 228 multilingual fifth graders, who acquired literacy in their second language German and learned capitalization of nouns since grade 1 according to the lexical approach. The spelling performance of the intervention group improved significantly compared to the passive control group that had received no training in capitalization of nouns but listening comprehension training in German. The study showed that the students of the intervention group mainly improved their spelling in the categories that are perceived as most difficult: the item type 'nominalizations' and the structure type in which the noun occurs as bare noun or preceded by an adjective. The differences in

the spelling patterns decreased in the intervention group after the training, as the influence of the lexical-semantic properties as well as the influence of the position of the noun in the noun phrase were reduced.

1.4 The present study

The present study contrasts the syntactic and the lexical approach to teaching capitalization of nouns. The former is assumed to be a comprehensive approach but is criticized as cognitively demanding. In turn, the latter is assumed to be easier at the beginning of literacy but is criticized by linguists, as it doesn't comprise the complexity of nouns, and results in many exceptions. The study aims to add evidence that syntactic interventions affect the capitalization of nouns in fifth graders and that the syntactic approach is feasible with multilingual spellers from Luxembourg. To achieve this, the study distinguishes two intervention groups and two control groups. The two intervention groups were trained according to the syntactic approach (Syn and SynBrick). The second intervention group (SynBrick) was added because observations in the training sessions of a previous study in our research group showed that some students had difficulties with identifying adjectives. Therefore, this group additionally used multisensory material that visualized the syntactic structures and adjective inflection with building bricks (Weth, 2017, 2020). One of the control groups was trained according to the lexical approach (Lex) and the second one was a passive control group exposed to German reading input (Read). The following hypotheses guided our work:

First, based on the results of a previous intervention study conducted by Bîlici et al. (submitted) who compared an intervention group trained according to the syntactic approach with a passive control group, we expect that the intervention groups instructed according to the syntactic approach (SynBrick and Syn) perform better regarding the capitalization of nouns compared to the control groups trained according to the lexical approach or in reading (H1a). The explicit training of strategies for identifying and extending noun phrases by inflected adjectives is assumed to enhance students' spelling performance regarding the capitalization of nouns. We expect the effects observed in the intervention groups in the posttest to remain stable in the follow-up test (H1b).

Second, the intervention groups (Syn and SynBrick) mainly improve their spelling of abstract nouns and nominalizations. Consequently, we expect less influence of lexical-semantic properties (concrete and abstract nouns and nominalizations) on the spelling performance regarding the capitalization of nouns in the intervention groups than in the control groups Lex and Read (H2a). Similarly, in the intervention groups, we expect less influence of the noun phrase (NP) structure type on the spelling performance regarding the capitalization of nouns than in the control group Lex. Thus, we expect the intervention groups (Syn and SynBrick) to improve their spelling regarding the capitalization of nouns in the NP structure types (noun pre-

ceded by adjective and determinant, noun preceded by adjective, bare noun) as students' knowledge about syntactic nouns was revised in the course of the syntax-based training (H2b).

Third, within the intervention groups, we expect the SynBrick group to outperform the Syn group due to the additional multisensory material, which is expected to provide support in grasping the structure of a sentence, the form-function relationship of a noun phrase, and the inflection of adjectives within the NP (Weth, 2017, 2020) (H3).

2. METHOD

Participants. The study's participants were 204 fifth-grade students (100 boys and 104 girls; mean age 133 months) from six schools situated in low ISEI (International Socioeconomic Index of Occupational Status) districts (ISEI scores between 35 and 45) in Luxembourg. The ISEI score indicates the socio-economic status of a household based on the income and level of education of the main earner (score between 16 and 90). All students had a multilingual educational background, as education in Luxembourg is trilingual: oral Luxembourgish in preschool, oral and written German since grade 1, oral French since grade 2, and written French since grade 3. Hence, all the fifth graders of this study acquired literacy in their second school language German. In the students' home districts, the proportion of families with Luxembourgish, a Germanic variety, as first language ranges between 20 and 40 percent only (MENJE & University of Luxembourg, 2015). In order to obtain language background information for our sample, a questionnaire was sent to the families by the teachers. The return rate was 65.1%. 44.7% indicated having one first language, whereas 1.3% indicated two first languages. 13.7% indicated Luxembourgish, 30.3% Portuguese, 10.9% Bosnian/Croatian/Serbian (BCS), and 10.3% another language as first language of the pupils. As Table 1 shows, first languages were distributed equally among intervention and control groups as assessed by Chi-square tests ($p > .05$).

Table 1. Frequencies of first languages (in %) in the intervention groups (Syn and SynBrick) and control groups (Lex and Read). BCS regroups Bosnian, Croatian and Serbian.

First languages	Intervention groups		Control groups	
	SynBrick	Syn	Lex	Read
	n = 30	*n* = 28	*n* = 26	*n* = 30
Luxembourgish	20	17.9	15.4	20.0
Portuguese	23.3	35.7	30.8	36.7
BCS	10	10.7	11.5	6.7
Other	6.6	3.6	7.6	6.7
Missing	40	32.1	34.6	30
Total	100	100	100	100

The study's participants learned capitalization of nouns according to the lexical approach, as all official textbooks are based on this approach. The fifth graders are considered relatively poor spellers, as their performance in a standardized German spelling test for grade 4 (*DRT 4—Diagnostischer Rechtschreibtest für 4. Klassen*) was below average considering the normed results of fourth graders with German as first language (Grund, Haug, & Naumann, 2004).

Only students that attended the Luxembourgish school system since grade 1 were included in the analyses. The study was granted ethical permission by the Research Ethics Committee of the University of Luxembourg and authorized by the National Centre for Data Protection in Luxembourg (CNPD). Head teachers gave consent for the testing procedure and intervention. Students were informed that they could drop out of the study at any moment.

Materials and procedure for pretest, posttest, and follow-up tests. Students were tested before the intervention (pretest), about 2 days after the intervention (posttest), and approximately 8 weeks after the intervention (follow-up test). The pretest consisted of two control tasks and two experimental tasks administered at two different days and after 10 to 12 weeks of schooling in grade 5. The posttest and follow-up tests comprised the experimental tasks only. All tasks (control and experimental tasks) were carried out as group tests in the classroom by the first author.

Control tasks. Reception of grammar was assessed with a German adaptation of the standardized Test for Reception of Grammar (TROG) (Fox-Boyer, 2011) and administered in a group setting (Lüke, Ritterfeld, & Tröster, 2016). A pre-recorded sentence was presented twice via audio-player. Students were asked to choose the picture that corresponded to the sentence from a selection of four pictures. In total, the test consisted of 36 multiple-choice items that gradually became more complex. For the correct attribution of the sentence to the picture, one point was given (maximum 36 points).

General spelling skills were assessed with the German standardized *Diagnostischer Rechtschreibtest für 4. Klassen* (DRT 4) ('Diagnostic Spelling Test for Grade 4'). The test consists of a gap-filling task with 42 items. Students had to fill in one item per sentence that was orally presented via audio-player. Every sentence was repeated twice, and the total dictation time was 30 minutes. The overall performance was analyzed: for every item written correctly according to German orthography one point was attributed.

Experimental tasks. A self-constructed syntactic marker test assessed the spelling regarding the capitalization of nouns. It consisted of a gap-filling dictation with a total of 88 independent sentences printed on worksheets. Participants had to fill in real words (48 target and 24 filler items) and 16 pseudowords. Sentences were recorded by a native German speaker and played through audio files. Every sentence was repeated twice with a 7 second interval. Between two different sentences, an interval of 10 seconds was inserted. The student scored 'correct' when writing the target items (nouns) in upper case and the filler items (verbs or adjectives) in lower case according to German orthography. No other orthographic errors were considered.

Among the target items, item type and NP structure type were manipulated. For the item type, concrete nouns (CON), abstract nouns (ABS), and nominalizations (NOM) were tested. Within each item type, four NP structure types were distinguished: nouns preceded by determiners (DN), nouns preceded by determiners and adjectives (DAN), nouns preceded by adjectives only (AN), and bare nouns (N). In every condition, four items were tested. Table 2 shows examples for every item condition.

Table 2. Items for each item type (CON = concrete nouns, ABS = abstract nouns, NOM = nominalizations) and each noun phrase (NP) structure type (DN = determiner + noun, DAN = determiner + adjective + noun, AN = adjective + noun, N = noun) in the syntactic marker test. English translation, frequency class and specification of the noun (mass noun (MN), nominalized verb (V) or adjective (A)) in brackets.

NP structure type	Item type CON	ABS	NOM
DN	*Koffer (case) (13)*	*Fleiß (diligence) (13, MN)*	*Grau (grey) (13, A)*
	Mehl (flour) (12, MN)	*Stille (silence) (11, MN)*	*Leuchten (shining) (12, V)*
	Holz (wood) (10, MN)	*Regeln (rules) (9)*	*Finden (finding) (10, V)*
	Straße (street) (7)	*Woche (week) (7)*	*Lernen ('learning') (9, V)*
DAN	*Kisten (boxes) (13)*	*Scherz (banter) (13)*	*Klettern (climbing) (13, V)*
	Obst (fruit) (11, MN)	*Schwäche (weakness) (12)*	*Orange (orange) (12, A)*
	Schnee (snow) (9, MN)	*Glaube (faith) (10, MN)*	*Liegen (lieing) (10, V)*
	Schüler (student) (7)	*Abend (evening) (7)*	*Laufen (running) (9, V)*
AN	*Wolle (wool) (13, MN)*	*Husten (cough) (13, MN)*	*Stehen (standing) (9, V)*
	Äpfel (apples) (12)	*Witze (jokes) (11)*	*Suchen (searching) (10, V)*
	Milch (milk) (10, MN)	*Ärger (trouble) (10, MN)*	*Rosa (pink) (12, A)*
	Spiele (games) (7)	*Nächte (nights) (7)*	*Schreien (shouting) (13, V)*
N	*Blumen (flowers) (13)*	*Kummer (sorrow) (13, MN)*	*Lesen (reading) (9, V)*
	Zucker (sugar) (11, MN)	*Wärme (heat) (11, MN)*	*Reden (talking) (10, V)*
	Fenster (windows) (9)	*Wünsche (whishes) (9)*	*Blau (blue) (12, A)*
	Wasser (water) (7, MN)	*Fragen (questions) (7)*	*Weinen (crying) (13, V)*

Target items were controlled for the following variables. The latter were presented in noun phrases as subject or direct object: The syntactic position of the NP including the target item (before or after the verb) and the syntactic function of the NP (subject or object) were balanced. Word frequency was balanced for all combinations of item types and NP structure types by using Leipziger Corpora Collection (2011). Every item condition comprised items from frequency class 7 (frequent), 9, 10, 11, 12 or 13 (less frequent) (see Table 2). The number of count nouns and mass nouns was balanced within every item condition as well as number (singular and plural). We controlled for the number of letters and syllables of the target items. No morphologically complex words (derivation suffixes, compositions) were used. Internal consistency of the pretest items was measured by using Cronbach's alpha (α =.922 for CON, α = .882 for ABS, α = .838 for NOM). The pretest and follow-up test were identical. For the posttest, items were integrated in different sentential contexts and two items were replaced because of possible misinterpretation.

Material and procedure for the intervention. The intervention was conducted in small groups of 4-5 participants, during regular classes in separate classrooms. All participants received eight training sessions of approximately 20 minutes in the course of four weeks. The training sessions were given by the first author and one trained instructor who followed the procedures described in a protocol. A booklet with the training material was provided to every group. Participants were designated 'linguistic researcher' in order to encourage their active role and to make the sessions attractive.

Intervention groups (Syn and SynBrick). The two intervention groups were both trained according to the syntactic approach to teach the capitalization of nouns. The sessions of both groups were constructed based on experimental material developed in other studies (Weth, 2020; Röber-Siekmeyer, 1999; Wahl et al., 2017). The sentences used in the training sessions included nouns from all lexical-sematic item types (CON, ABS, NOM) and were presented in all NP structure types (DN, DAN, AN, N). The first group (Syn) was trained for the identification of noun phrases and their extension with inflected adjectives on paper-pencil. Participants were trained to apply different strategies in order to analyze a sentence: identify noun phrases and head of noun phrases by expanding NP with inflected adjectives (focus on inflection), to find the head of the NP which has to be capitalized. The aim was to foster students' access to syntactic information. The second intervention group (SynBrick) was trained similarly as the Syn group, but in addition the sentence was also presented to them with multisensory material visualizing the syntactic structures and adjective inflection with building bricks (Weth, 2017, 2020). The bricks had different colors and sizes and are indeed abstract representations of grammatical words and of grouping of words into noun phrases. In addition, they highlight the agreement structure within the noun phrase by adding inflection morphemes on attributive adjectives. The assumption for the use of bricks was the fact that their schematic representation of word classes, phrase structures and inflectional endings on adjectives would support the acquisition of the trained syntactic categories. The aim was to decrease

competition between multiple cues present in any expression to increase salience of the agreement within the noun phrase (Ellis, 2006a, 2006b). The manipulation of the bricks might draw increased attention to the syntagmatic structures and might facilitate the perception of the form-function relation within the NP. The students were asked to represent the written sentence by stringing together respective bricks. The words forming a noun phrase were put together on a larger brick. The inflection of attributive adjectives was symbolized by adding a small black brick onto the yellow brick, representing the adjectives. The intervention group SynBrick participated in the same amount of training sessions as all other groups. The grammar bricks were not at the participants' disposal during the tests.

Control groups (Lex and Read). The Lex control group was trained according to the lexical approach to teach the capitalization of nouns. The sessions were constructed based on corresponding exercises taken from official school textbooks used in Luxembourgish schools. The training consisted of revising capitalization rules that all participants learned since grade 2. Nominalizations were newly introduced in the training sessions. The additional lexical training was implemented in order to ensure same training conditions for all students. The Read control group, a passive control group, served to exclude the potential impact of a Hawthorne effect on the test scores of the groups provided with an explicit training in capitalization. In this group, short stories were read either by the instructor or by the students, and questions related to the story were answered in plenum. Although no explicit training of capitalization was given, the Read group received written German input which activated reading and reading comprehension. An overview of the experimental design is given in the Appendix.

Implementation. Initially the sample consisted of 204 students. For the below-mentioned reasons 90 students were excluded and resulted in the final sample size of 114 students. No informed consent for participation was obtained from seven parents (N = 197). No participation in the pretest was an exclusion criterion for five students (N = 192). Performance (less than 50% correct answers) in the German test for reception of grammar (TROG) and 'very poor' (percentile ranks between 0 and 10) performance in the standardized German general spelling skills test (DRT 4) excluded two participants from the total sample (N = 190). Thus, sufficient grammar comprehension was assumed as the participants retained had at least 50% correct answers in the TROG. Based on the individual pretest scores in the syntactic marker test, the sample (N = 190) was divided in three performance groups: $\leq$ 25% (poor spellers), > 25 and < 75% (medium spellers) and $\geq$ 75% (strong spellers). From each performance group, students were then quasi-randomly assigned to two intervention groups (Syn and SynBrick) and one control group. The control group was afterwards split into two control groups (Lex and Read), each including approximately the same number of poor, middle, and strong spellers. Due to this procedure, the number of children in the intervention groups (Syn: n = 65; SynBrick: n = 62) was higher than in the control groups (Lex: n = 30; Read: n = 33) and led to unequal group sizes. The analyses, described in the results section, were first performed on the unequal

group sizes (*N* = 190). In order to ensure that the observed significances and effect sizes are not due to unequal group sizes, a case-control matching was performed. Gender, first language, and performance group were the selected variable to match on. The matched groups had approximately the same number of students (Syn: *n* = 30; SynBrick: *n* = 33; Lex: *n* = 30; Read: *n* = 33; *N* = 126). No participation in posttest and/or follow-up test excluded 12 children from the matched sample (Syn: *n* = 28; SynBrick: *n* = 30; Lex: *n* = 26; Read: *n* = 30; *N* =114). In total, 114 students were in the sample with matched groups. As Table 3 shows, performance in the pretests (TROG, DRT 4, syntactic marker test) was not different between the four groups as assessed by one-way ANOVAs.

Table 3. Means (in % correct), standard deviations (in brackets), F- and p-values of the pre-test scores in the reception of grammar test, the general spelling test and the syntactic marker test of the intervention (Syn and SynBrick) and the control groups (Lex and Read).

	Intervention groups		Control groups		One-way ANOVA	
	Syn (*n*= 28)	SynBrick (*n*= 30)	Lex (*n*= 26)	Read (*n*= 30)		
Measure	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*F*	*p*
Reception of grammar (TROG)	84.22 (8.16)	83.98 (9.42)	84.51 (8.28)	81.20 (11.22)	.878	.455
General spelling skills (DRT 4)	56.80 (21.23)	58.16 (20.82)	63.64 (19.89)	54.76 (15.85)	1.035	.380
Syntactic marker test	65.56 (13.98)	68.70 (14.37)	68.22 (16.23)	63.98 (11.36)	.740	.531

3. RESULTS

Students' correct spellings regarding the capitalization of nouns were analyzed. Main variables that could influence the test scores were item type and the structure type of NP. Three item types were considered: CON, ABS, and NOM. Four structure types of NP are distinguished: DN, DAN, AN and N. A 3 (CON, ABS, NOM) x 4 (DN, DAN, AN, N) x 3 (pretest, posttest, follow-up test) repeated measures ANOVA with group (Syn, SynBrick, Lex, Read) as the between-subjects factor was used. Table 4 gives an overview of the pretest, posttest, and follow-up test means as well as standard deviations for all item and NP structure types for the intervention and the control groups.

Table 4. Means (% correct) and standard deviations (in grey) of the correct responses of the intervention groups (SynBrick and Syn) and the control groups (Lex and Read) in the pre-, post- and follow-up test for all item conditions (Con = concrete nouns, ABS = abstract nouns, NOM = nominalizations, DN = determinant + noun, DAN = determinant + adjective + noun, AN = adjective + noun, N = noun) in the syntactic marker test.

Test condition	Pretest								Posttest								Follow-up test							
	Intervention groups				Control groups				Intervention groups				Control groups				Intervention groups				Control groups			
	SynBrick		Syn		Lex		Read		SynBrick		Syn		Lex		Read		SynBrick		Syn		Lex		Read	
Item type																								
CON	86.88	*17.40*	85.05	*23.34*	84.38	*24.83*	82.92	*20.16*	86.25	*21.04*	83.71	*27.18*	81.01	*25.40*	80.63	*21.92*	88.54	*18.79*	84.82	*18.97*	90.63	*17.43*	84.38	*22.49*
ABS	57.71	*27.89*	50.45	*28.61*	57.69	*32.37*	49.79	*23.18*	69.38	*30.28*	63.62	*32.41*	60.01	*32.79*	50.42	*27.51*	64.17	*32.20*	64.96	*33.65*	68.75	*27.16*	53.13	*27.70*
NOM	25.83	*24.22*	18.75	*18.71*	21.15	*24.37*	17.08	*14.86*	47.50	*33.62*	47.32	*34.12*	33.65	*31.13*	16.46	*17.64*	41.46	*33.09*	44.87	*34.19*	31.25	*29.10*	18.75	*20.57*
NP structure type																								
DN	66.67	*22.16*	58.79	*20.75*	61.24	*26.06*	60.00	*20.84*	74.10	*28.24*	74.45	*27.54*	68.05	*26.35*	58.21	*21.35*	70.77	*27.51*	75.55	*24.95*	70.71	*23.54*	60.77	*22.71*
DAN	55.00	*22.81*	51.19	*21.72*	53.85	*27.41*	47.50	*21.01*	65.83	*30.59*	63.69	*32.88*	58.33	*29.25*	50.00	*21.44*	63.33	*28.08*	63.39	*29.25*	64.74	*25.42*	52.50	*21.90*
AN	51.39	*23.58*	47.32	*22.80*	53.53	*25.51*	45.00	*18.77*	66.11	*28.11*	62.20	*30.64*	54.49	*29.27*	46.11	*19.91*	61.39	*27.38*	61.61	*33.44*	59.29	*22.03*	46.67	*22.17*
N	53.03	*20.82*	47.40	*17.03*	47.90	*20.50*	46.06	*17.37*	63.94	*24.40*	57.79	*27.80*	50.70	*25.86*	40.91	*20.50*	62.73	*24.74*	57.47	*26.88*	58.39	*20.92*	47.27	*23.07*

The preliminary inspection of the normal distribution of test scores, assessed by the Shapiro-Wilk test, indicated deviations from normality in some cases (p >.05). Despite the deviation from normality, ANOVAs were performed as they are robust against a violation of the normal distribution (Salkind, 2010).

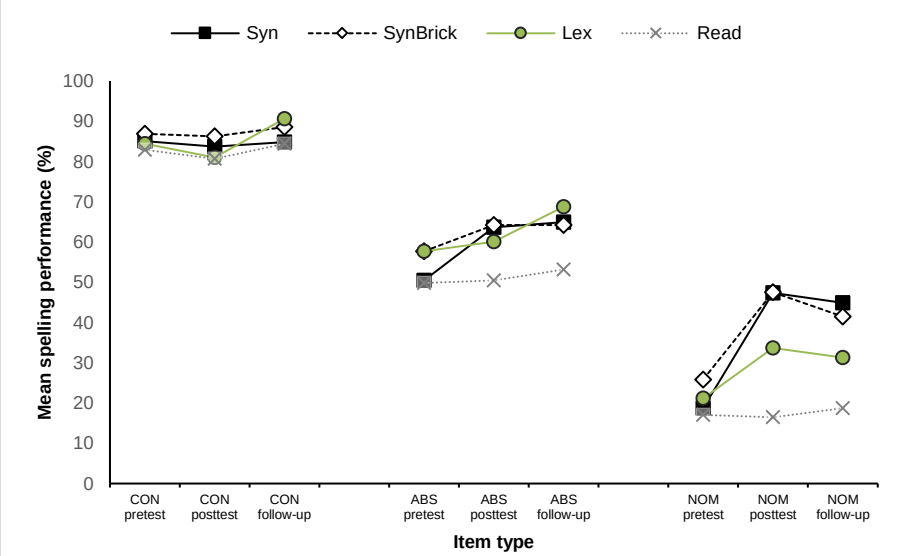
Regarding our first hypothesis on the effect of the different trainings for students' spelling of capitalizations (all item types and NP structure types together), the *interaction test session*group* was significant (F (6, 220) = 2.968, p < .01, η_p^2= .075). The effect of the test session was different depending on the group. Bonferroni pairwise comparisons indicate that the two intervention groups *Syn and SynBrick* improved significantly more from pretest (Syn: M = 51.40; Syn Brick: M = 56.45) to posttest (Syn: M = 64.52; SynBrick: M = 67.67) (p < .001) than the two control groups *Lex* and *Read* (pretest: Lex: M = 54.19; Read: M = 49.75; posttest: Lex: M = 57.95; Read: M = 48.81). The intervention groups and the Lex group improved significantly more from pretest to follow-up test (Syn: M = 64.81; SynBrick: M = 64.75; Lex: M = 63.59) than the Read group (M = 51.93). The differences in scores between posttest and follow-up test were not significant for the four groups.

Regarding our second hypothesis, we specifically analyzed the effect of the different trainings on capitalization with the item type and the NP structure type. Due to significance of Mauchly's Test of Sphericity, the Greenhouse Geiser correction for the main effect of item type, the interaction NP structure type*item type, the interaction item type*test session, and the interaction NP structure type*item type*test session was reported. There was a *main effect of item type* (F (1.807, 198.777) = 467.137, p < .001, η_p^2 = .809). Bonferroni pairwise comparisons indicate that there was more correct spelling for the item type CON (M = 84.93) than for ABS (M = 58.67) and NOM (M = 30.34). The difference in spellings between the item type ABS and the NOM was significant as well.

The *main effect of NP structure type* (F (3) = 69.658, p < .001, η_p^2 = .388) was significant. There were more correct spellings for the NP structure type DN (M = 68.68) than for DAN (M = 57.447), AN (M = 54.592) and N (M = 53.201). In addition, the difference in spellings was significant between the NP structure type DAN compared to AN and N. The performances for the NP structure types AN and N were not significantly different. The *interaction item type*test session*group* was significant (F (10.446, 384.021) = 2.922, p = .001, η_p^2 = .074). The effect of item type on spelling scores was different depending on the test session and on the group. Bonferroni pairwise comparisons indicate that for the item type CON, spelling did not improve significantly different from pretest (Syn: M = 85.05; SynBrick: M= 86.88; Lex: M = 84.38; Read: M = 82.92) to posttest (Syn: M = 83.70; SynBrick: M= 86.25; Lex: M = 81.01; Read: M = 80.63) and from posttest to follow-up test (Syn: M = 84.82; SynBrick: M = 88.54; Lex: M = 90.63; Read: M = 84.38), except in the Lex group from posttest to follow-up test (p <.01). For the item type *ABS*, spellings improved significantly more in the intervention groups from pretest (Syn: M = 50.40; SynBrick: M = 56.64) to posttest (Syn: *M = 62.54*; SynBrick: M = 69.25) than in the control groups (pretest: Lex: M = 57.69; Read: M =49.79; posttest: Lex: M = 60.01; Read: M = 50.42). The Syn

group and the Lex group improved significantly from pretest (Syn: *M* = 50.40; Lex: *M* = 57.04) to follow-up test (Syn: *M* = 64.73; Lex: *M* = 68.80) ($p < .01$). Spelling did not improve significantly from posttest to follow-up test in the four groups ($p > .05$). For the item type *NOM*, spelling performance improved in the Syn, the SynBrick and the Lex group from pretest (Syn: *M* = 18.75; SynBrick: *M* = 25.83; Lex: *M* = 21.15) to post-test (Syn group: *M* = 47.321; SynBrick: *M* = 47.5; Lex: *M* = 33.65). In addition, spelling for the item type NOM improved significantly more from pretest to follow-up test in the Syn (*M* = 41.458) and the SynBrick (*M*= 44.866) groups than in the Lex group (*M* = 31.25). Spelling performance did not improve significantly more from posttest to follow-up test in the four groups (all $p > .05$). Figure 1 shows the spelling performance of the intervention and control groups for all item types (CON, ABS, NOM) in the three test sessions.

Figure 1. Spelling performance (in % correct) in the pretest, posttest and follow-up test for the item types CON (concrete nouns), ABS (abstract nouns) and NOM (nominalizations) of the intervention groups (SynBrick and Syn) and the control groups (Lex and Read).

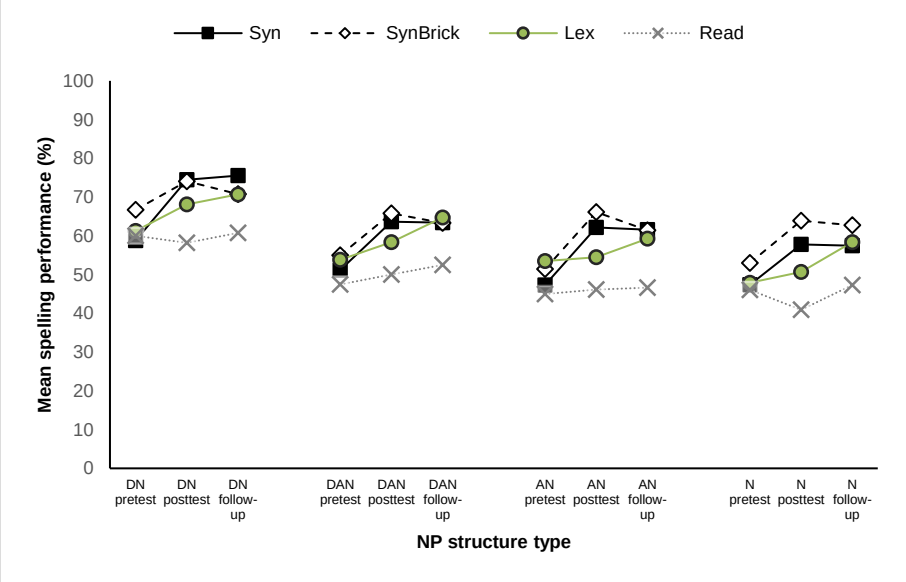


No significant interactions including NP structure type were observed: The interaction NP structure type*test session ($F < 1$) was not significant, nor was the interaction NP structure type*test session*group ($F < 1$). The effect of NP structure type on scores was not different depending on the test session and depending on the group.

In addition, the interactions including item type and NP structure type were not significant (NP structure type*item type *test session ($F = 1$), item type* NP structure

type*test session*group (F = 1). The effect of the NP structure type on the test session and on the group was not different depending on the item type. Figure 2 shows the spelling performance of the intervention and control groups for all NP structure types (DN, DAN, AN, N) in the three test sessions.

Figure 2. Spelling performance (in % correct) in the pretest, posttest and follow-up test for the NP structure type DN (determinant + noun), DAN (determinant + adjective + noun), AN (adjective + noun) and N (noun) of the intervention groups (SynBrick and Syn) and the control groups (Lex and Read).



Spelling of the filler items. Filler items were integrated in the gap-filling dictation test in order to control for an overuse of capitalization. Filler items (verbs or adjectives) which did not require syntactical marking with an uppercase letter according to German orthography were included in the gap-filling dictation task. In the pretest, the intervention groups spelt 92% (SynBrick) and 94% (Syn) of the filler items correctly with respect to capitalization. The control groups wrote 96% (Lex) and 92% (Read) of the filler items with a lower-case letter. In the posttest, both intervention groups (SynBrick and Syn) spelt 92% of the filler items correctly. The control groups wrote 95% (Lex) and 93% (Read) of the filler items correctly. A repeated measures ANOVA on the pretest, posttest, and follow-up test scores for filler item types (verbs and adjectives) with group (SynBrick, Syn, Lex, Read) as between-subjects factor was conducted. There was a main effect of filler item type (F (1, 110) = 109.019, p < .001, η_p^2 = .498). There were more correct spellings for the verbs (M = 95.693) than for adjectives (M = 87.801). The interaction of filler item type*group was not significant (F =

1). The filler item types were performed similarly in all groups. The interaction filler item type*test session was significant (F (2, 220) = 35.815, $p < .01$, $\eta_p^2 = .246$). The correct spelling of adjectives decreased significantly from pretest (M = 91.53) to posttest (M = 82.75) and increased significantly from posttest to follow-up test (M = 89.129). For verbs, the spelling performance did not significantly change from pretest to posttest and follow-up test. The interaction test session*group ($F < 1$) was not significant. This suggests that the spelling performance of filler items did not depend on the test session or the group. Although the spelling of capitalized adjectives increased in the posttest, the results might not have been influenced by an overuse of upper-case letters after the training. The interaction item type*test session*group was not significant ($F = 1$). The effect of item type did not depend on the test session and the group.

4. DISCUSSION

The current study evaluates the effectiveness of an intervention in the spelling performance of multilingual students from low SES districts with respect to the capitalization of nouns. The study included two intervention and two control groups. The intervention groups received a training in capitalization according to the syntactic approach, one of them with and one without additional multisensory material. Students were trained to apply strategies that allow identifying and extending noun phrases. One control group followed a training in capitalization according to the lexical approach and was trained to focus on lexical-semantic properties and the test of the determinant. The second control group received written input in order to activate reading comprehension.

In the following, we discuss, first, the general effect of the trainings (H1a and H1b) and, second, the influence on students' spelling performance regarding item type and on NP structure (H2a and H2b). The results of the pretest and posttest show that spelling performance regarding capitalization improved significantly for the intervention groups. The comparison between the two current didactic approaches to capitalization showed a *clear advantage for the syntactic approach.* The general improvement in the intervention groups needs to be emphasized, especially regarding the fact that the intervention groups learnt a new method to recognize nouns in a noun phrase, whereas the control groups received a revision of what all students had learnt from second grade on. Thus, our results confirm and reinforce previous results regarding the effectiveness of the syntactic approach with L1 learners (Wahl et al., 2017) and L2 learners (Bîlici et al., submitted).

Between pretest and posttest, a clear tendency of a reduced influence of item type (CON, ABS, NOM) and, consequently, of the lexical-semantic properties was identified in the intervention groups. The trainings according to the syntactic approach led to a significant improvement in the spelling of abstract nouns and nominalizations, thus confirming that the use of syntactic strategies is promising for improving spelling of the item types for which the lexical approach is difficult to apply,

namely abstract nouns and nominalizations (Wahl et al., 2017; Bîlici et al., submitted). This result suggests that after the syntactic training the students were able to identify the noun phrase and its head regardless of its lexical-semantic properties. Despite the improvement for abstract nouns and nominalizations, the scores did not reach the scores for concrete nouns. On the one hand, this could be explained by the relatively short intervention time, which was probably not long enough to balance out lexical differences. On the other hand, the score differences indicate that lexical information of the item type cannot be entirely neglected.

In the Lex control group, the spelling of nominalizations improved significantly from pretest to posttest as well. Unlike concrete and abstract nouns, nominalizations had been newly introduced to the students during the training sessions. In contrast, all students had been previously instructed to spell concrete and abstract nouns according to the lexical approach in regular classes. Therefore, an improvement for this item type could be expected in all groups which received explicit training in capitalization.

Regarding long-term effects, no significant improvement nor decline was observed from posttest to the follow-up test eight weeks later. This result shows that the effectiveness of the syntactic approach still remains eight weeks after the training sessions. Thus, we can assume that the students in the intervention groups continue to apply the newly learned strategies in the longer term.

The *Read* control group did not improve their general spellings of capitalization in either the posttest or the follow-up test. An improvement in the capitalization of nouns due to mere exposure to written input in German can be excluded.

A reduced influence of the *structure type of the noun phrase* (DN, DAN, AN, N) was not found. This finding contrasts with the study reported in Bîlici et al. (submitted), in which the students improved significantly for the structure types DAN (noun preceded by adjective and determinant), AN (noun preceded by adjective), and N (bare noun), and consequently reduced the influence of the structure types. However, on the descriptive level, we observe that the intervention groups improve their scores for all NP structure types in the posttest, where the performance for DAN, AN, and N almost catches up with the initial high performance for DN in the pretest. In contrast, for the Lex control group, the scores in the posttest for DAN, AN, and N do not match the initial high performance for DN in the pretest. Intervention groups and the Lex control group are on the same level in the follow-up test due to a slight decrease in the intervention groups and a continuous increase in the lexical group. In addition, and in contrast to the study conducted by Bîlici et al. (submitted), no interactions between item type and NP structure type were found in our study. The different results might be due to the samples: The sample used by Bîlici et al. (submitted) included a total of 246 students divided into two groups, which may have allowed them to find a significant effect of NP structure type and interactions between NP structure type and item type. In contrast, small effects may not have been visible in our study due to the smaller sample size that was divided into 4 groups.

With regard to the two syntactic groups, we were interested in the differences between the two intervention groups with and without an additional multisensory material. The material was introduced due to the difficulties a previous study had observed in the recognition of adjectives during the training according to the syntactic approach. Additional multisensory material was expected to enable the students to grasp the form-function relationship of a noun phrase and the inflection of adjectives within the NP (Weth, 2017, 2020). However, no significant difference between the two *syntactic groups* were found. This might be explained by the additional content of instruction in the SynBrick group. As the Syn group and the SynBrick group learned to apply the same syntactic strategies in eight sessions of approximately twenty minutes, no additional training sessions were implemented in the SynBrick group in order to familiarize the students with the bricks. In addition, the SynBrick group could not use the bricks during test sessions. These conditions might have put the SynBrick group at a disadvantage and might explain why the group did not improve more than the Syn group.

The results for the filler items show that there was no overuse of capitalization. Thus, the explanation of a general increase of items with capital letter after the training can be excluded. Interestingly, there were more correct spellings (initial lowercase letter) for verbs than for adjectives. This result is in line with the findings of Scheele (2006) and Betzel (2015), who attribute the difference to adjectives used in attributive function. A further analysis of the items is necessary to confirm this.

The present study has several limitations. First, the sample size indicates reduced statistical power. The decision to reduce the size of the intervention groups was taken in order to compare groups of equal size and thereby reduce the risk of observed effects being due to unequal group sizes. However, analyses were also done with the initial sample, and the same effects were observed in almost all cases.

Second, no information on teaching content between posttest and follow-up test was available to the researchers. Teachers were asked to avoid teaching capitalization, but we did not control for teaching content. However, even if teachers were teaching capitalization with the lexical approach, the instructions did not have a significant negative effect on the performance of the intervention groups.

Third, the syntactic marker test was probably not suitable for observing differences between the syntactic trainings with and without multisensory material. A closer inspection of the training sessions of the SynBrick group seems to be crucial in order to understand the processes occurring in this group and to explain in more detail why the performances do not differ from those in the Syn group. A qualitative analysis of the videos recorded during the training sessions will facilitate this in-depth insight.

The study's outcomes have some theoretical and didactical implications. It adds evidence that the implementation of the syntactic approach fosters the spelling of L2 students with different home languages and from schools situated in low SES districts, as relatively poor spellers profited from manipulating syntactic structures

for their spelling, and as a reduction of lexical-semantic properties in the intervention groups was identified. The findings need to be highlighted given the fact that the fifth graders of this study had already been trained with the lexical approach for four years. During the training, the intervention groups were confronted with a new, alternative, syntactic teaching method and improved even more than the control group that was trained with the familiar lexical approach. This suggests that syntactic training might be introduced at an earlier stage of schooling in order to avoid a relearning process. Finally, the study has theoretical implications regarding syntactic markers in general and its teaching. The findings suggest that a greater focus on syntactic structures in teaching is beneficial in order to learn capitalization of nouns in German. The results are consistent with international studies that indicate that syntactic training improves the spelling of orthographic syntactic markers. Hence, this study provides further evidence that the focus in spelling didactics should shift from a word-related to a sentence-related approach, especially if the syntactic level is concerned.

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APPENDIX

Table A1. Overview of the experimental design of the study. Please note that the number of participants (N=114) corresponds to the sample sizes included in the statistical analyses.

Timeline				
Pretest (*N*=114)				
		Groups		
	Intervention		Control	
Sessions (2 per week, 20 mins each)	SynBrick (*n*=30)	Syn (*n*=28)	Lex (*n*=26)	Read (*n*=30)
		Contents		
1	Introduction to the bricks	Introduction to new approach Identifying and extending noun phrases	Assign concrete and abstract nouns to different categories	Story 1 Questions and answers in plenum
2	Identifying and extending noun phrases with bricks	Identifying and extending noun phrases	Test of the determinant	Story 1 Questions and answers in plenum
3	Identifying and extending noun phrases with bricks	Identifying and extending noun phrases	Test of determinant Plural of nouns	Story 2 Questions and answers in plenum
4	Focus on the inflection of attributive adjectives with bricks Distinction between attributive and adverbial adjectives	Focus on the inflection of attributive adjectives Distinction between attributive and adverbial adjectives	Articles and adjectives precede the noun	Story 2 Questions and answers in plenum
5	Identifying and extending noun phrases including nominalizations with bricks	Identifying and extending noun phrases including nominalizations	Adjectives and nominalized adjectives	Story 3 Questions and answers in plenum
6	Identifying and extending noun phrases including nominalizations with bricks	Identifying and extending noun phrases including nominalizations	Verbs and nominalized verbs	Story 3 Questions and answers in plenum
7	Identifying and extending noun phrases including nominalizations With bricks	Identifying and extending noun phrases including nominalizations	Nominalizations	Story 4 Questions and answers in plenum
8	Summary and revision	Summary and revision	Summary and revision	Story 4 Questions and answers in plenum
Posttest (*N*=114) - immediately after the last session				
Follow-up test (*N*=114) - 8 weeks after the posttest				