Ferran Suñer* and Jörg Roche

Embodiment in concept-based L2 grammar teaching: The case of German light verb constructions

https://doi.org/10.1515/iral-2018-0362

Abstract: German light verb constructions are especially challenging for advanced L2 learners because of the abstract meaning of the different verbs and the high degree of lexico-grammatical variety. Acknowledging that language is a symbolic system representing humans' perception of the world and is thus strongly linked to embodied experiences, this study explores the potential of bodily engagement in the form of multimedia animations for leveraging the learning of embodied concepts related to light verb constructions. To this end, thirty-nine French-speaking learners of German were divided into two groups: The first group worked with animations illustrating the embodied nature of light verb constructions and performed specific tasks that set out to trigger mental simulation of relevant embodied concepts; the second group was presented with form-based explanations and completed tasks focusing on the different categories of light verb constructions. The results show that the use of bodily engagement in the form of multimedia animations led to significantly better performance and contributed to some extent to changing students' attitudes about how grammar can best be learned.

Keywords: embodied learning, grammar teaching, light verb construction, multimedia learning

1 Introduction

Over the past few decades, embodied cognition research has substantially contributed to our understanding of how our sensory experiences in the physical world are linked to cognitive processes (Barsalou 1999; Beilock 2015; Glenberg 2010; Lindgren and Johnson-Glenberg 2013; Shapiro 2010). A recent review of

***Corresponding author: Ferran Suñer,** Faculty of philosophy, arts and letters Institute for Langage et Communication Université Catholique de Louvain, Louvain-la-neuve, Belgium, E-mail: ferran.suner@uclouvain.be
Jörg Roche, German as a Foreign Language, Ludwig-Maximilians-Universität München, Munich, Germany, E-mail: roche@daf.lmu.de

research by Skulmowski and Rey (2018) shows that there are a wide variety of ways to transfer insights from embodied cognition research into various fields of learning. Studies in this area cover educational settings involving learners' full-body actions (e. g. Johnson-Glenberg et al. 2014; Lindgren et al. 2016), embodied simulations in augmented reality environments (e. g. Lindgren 2015; Tscholl and Lindgren 2014; Yilmaz 2016; Yoon et al. 2012, 2017) as well as gesturing (for an overview see Pouw et al. 2014). In the context of foreign language learning and teaching, bodily engagement has also received a great deal of attention (e. g. Driver 2012; Wik and Hjalmarsson 2009). In most cases, however, instructional methods were not consistently grounded in a theoretical framework that properly describes the links between language and embodied cognition. By contrast, the cognitive linguistic view of language (e. g. Clausner and Croft 1999; Langacker 2008) offers just that, since it states that language represents the perceived world in the form of image schemas which in turn are represented as metaphors. As such, language is metaphorical, an embodied representation of the world per se (cf. *Embodied Hypothesis*, Evans 2012). So far, the application of these insights to language teaching has led to a growing body of research focusing on whether the integration of such embodied experiences can facilitate access to relevant concepts of grammar that often remain hidden to learners, and can compensate for overemphasis on the formal aspects of grammar (Bielak and Pawlak 2011; Jacobsen 2018; Kohl-Dietrich 2016; Reif 2012; Tyler et al. 2011; Yasuda 2010). In this context, only a few studies have investigated to what extent multimedia animations can trigger the bodily engagement needed to learn dynamic aspects of grammar (Kanaplianik 2016; Scheller 2009). Overall, the results demonstrate the great potential of multimedia animations for the presentation of the embodied concepts underlying the different grammar structures. However, as this has only been applied to a very limited number of grammar areas, further empirical evidence is needed in order to make stronger claims (Roche and Suñer 2017).

Against this background, this article reports on a classroom-based study that aims to investigate the effectiveness of multimedia animations for the visualization of embodied concepts related to so-called light verb constructions in German (e. g. Germ. *eine Rede halten*, 'to give a speech'). On the one hand, the cognitive linguistic approach used for the description of these constructions draws upon embodied experiences in order to better elucidate the meaningfulness of the respective light verbs as well as the conceptual links between the different types of light verb constructions (Gradečak-Erdeljić 2009), both aspects being specially challenging for advanced learners of German. On the other hand, the use of animations is expected to produce added value for the visualization of relevant embodied concepts, since they facilitate both the spatial and the

temporal integration of dynamic situations as well as the better processing of dynamic aspects of grammar and thus the performance of the required model transformations (Lowe and Schnotz 2014).

In Section 2, we report on findings from previous research applying embodied learning to different educational fields with a special emphasis on language teaching. Section 3 presents the theoretical underpinnings of a concept-based approach that sets out to make the conceptual motivation of light verb constructions more transparent to learners. The methodology used for the classroom-based study as well as the results are presented in Sections 5 and 6. Sections 7 and 8 discuss the results, formulate pedagogical implications and suggest some directions for further research.

2 Literature review

Barsalou's (1999) framework of perceptual symbol systems, according to which our mental representations of the world are grounded in sensory-motor systems and are thus "analogically related to the perceptual states that produced them" (p. 578), has been widely applied to educational research. Previous studies in this field have intensively investigated bodily engagement and task integration as two of the main variables affecting the effectiveness of classroom settings based on embodied learning (Johnson-Glenberg et al. 2014). In this context, Skulmowski and Rey (2018) suggest a taxonomy that considers different levels of bodily engagement and task integration. The authors describe the motor engagement derived from watching animations and/or the interaction with the animations as belonging to lower levels of bodily engagement. By contrast, learning activities requiring learners to perform movement and locomotion are linked to higher levels of bodily engagement (cf. Johnson-Glenberg et al. 2014). Generally speaking, the review by Skulmowski and Rey (2018) indicates that higher levels of bodily engagement per se will not in all cases lead to better learning outcomes (see Tran et al. 2017). In their review, the authors report on studies featuring comparisons between learning settings with and without activities fostering bodily engagement on the one hand, and studies comparing learning settings with activities that require a varying degree of bodily engagement on the other hand (e. g. Skulmowski et al. 2016; Johnson-Glenberg et al. 2014). In this context, studies involving computer interactions also show that physical performance can be substituted or enhanced by virtual animations as long as there are semantic ties between the actions performed by students and the concepts to be learned (e. g. Monaghan and Clement 1999; Pouw et al. 2016;

see also Lindgren and Johnson-Glenberg 2013: 448). Furthermore, some authors have stated that the success of treatments involving computer interactions is subject to the additional cognitive load needed to perform the required mental manipulations, which might vary considerably depending on the learning objects (cf. Reed 2018).

It is important to note that the degree of task integration appears to be more important for positive learning effects than mere bodily engagement. In other words, semantically related forms of bodily engagement or an equivalent representation thereof tend to yield better results, if they are properly integrated in the learning setting and not just performed incidentally (see Gallagher and Lindgren 2015; Hutto et al. 2015). In the area of language, a study by Glenberg et al. (2004) revealed that the physical performance of a story can lead to enhanced reading comprehension (see also Ionescu and Ilie 2018). The participants in the study were found to perform better in memory and comprehension tests when they manipulated concrete objects with the aim of simulating actions related to the stories. Taken together, the studies from educational research reported so far stress the importance of integrating bodily involvement into learning settings and point out that increases in bodily engagement will not automatically be accompanied by an increased learning performance (cf. Johnson-Glenberg et al. 2014; Skulmowski and Rey 2018).

In the field of foreign language teaching and learning, there is also a growing body of empirical research on the effectiveness of cognitive linguistic approaches featuring embodied concepts of grammar. These studies, however, fail to document an overall positive effect on language learning compared with traditional form-based approaches (e. g. Bielak and Pawlak 2011; Bielak et al. 2013; Kohl-Dietrich et al. 2016; Reif 2012; Tyler 2008; Tyler et al. 2011; Yasuda 2010). The results demonstrate that merely presenting cognitive linguistic notions does not always initiate direct access to the conceptual aspects of grammar and the authors claim that additional aspects need to be taken into account such as the presentation mode (cf. Roche and Suñer 2016; Tyler et al. 2011). Consequently, another group of studies considered the insights from embodied learning research and showed that using animations for the presentation of embodied concepts of grammar is crucial to achieve sustainable learning effects (cf. Grass 2013; Kanaplianik 2016; Scheller 2009). In fact, animations provide learners with an external visual representation that triggers the construction of appropriate mental models containing the dynamic aspects of a particular grammatical structure (Lowe and Boucheix 2016). The use of static images would instead require the learners to add the spatial-temporal aspects by themselves and would thus cause an additional mental effort. It is also important to note that animations are especially efficient, when they are

designed according to the principles of the cognitive theory of multimedia learning (Mayer 2014). For instance, the dynamic content portrayed by the animations needs an identifiable connection to the conceptual motivation of the grammar principles in question (cf. *coherence principle*, Mayer 2014). Furthermore, Scheller (2009) stresses the importance of carefully planning the use of visual material and specific technical effects in order to guarantee that perceptual processing is well aligned with the cognitive requirements of mental model construction (Lowe and Schnotz 2014: 518). In other words, animations must be designed in such a way that perceptually salient elements correspond with thematically and cognitively relevant elements for learning. Violating this principle can lead to a loss of cognitive resources and, in turn, an increase in the overall cognitive load (cf. Mayer 2014; Sweller et al. 2011). By abandoning the use of more decorative design methods common to commercial language learning software the extrinsic cognitive load can instead be reduced to minimal levels (cf. Sweller et al. 2011).

Overall, we can assume that the bodily engagement fostered by the representation of embodied concepts of grammar animations can leverage the grammar learning process. In the next section, we present the theoretical underpinnings of a concept-based approach to German light verb constructions that draws upon embodied experiences in the form of image schemas to make the conceptual motivation of these constructions more transparent to learners.

3 Concept-based approach to German light verb constructions

Traditionally, light verb constructions have been neglected by teachers and textbooks of German as a foreign language. There may be various reasons for this, such as their allegedly low frequency in everyday communication or their alleged complexity. It might also be explained by the fact that light verb constructions exhibit a high degree of constructional variability that makes it very difficult for learners to notice them systematically in the input. As a consequence, learners become aware of light verb constructions at a relatively late stage in their progress towards higher proficiency levels (C1-C2 on CEFR scale). Awareness of light verb constructions often sets in when learners are encouraged to produce more advanced academic texts. To this end, learners are typically presented with lists clustering light verb constructions according to different formal criteria (e. g. same preposition, same verb, etc.) but fail to elucidate their meaningfulness. The rather formalistic approach (e. g.

Dependency Grammar, Weber 1997) characterizes light verbs as semantically empty and the choice of prepositions as arbitrary, thus hindering learners from creating appropriate form-meaning pairings. To make matters worse, creating conceptual links between different light verb constructions remains a major challenge since the target structures are generally presented as isolated items.

Against the backdrop of typical challenges for language learners, the concept-based approach to teaching light verb constructions sets out to compensate for the overemphasis on formal aspects that is typical of common language classes by using embodied experiences (force, dynamics, movement, etc.) in the form of so-called image schemas (e. g. SOURCE-PATH-GOAL; Oakley 2007). This study therefore defines image schemas as those patterns that recur in a variety of embodied domains and are then generalized to describe nonphysical relationships such as grammatical concepts (Clausner and Croft 1999: 14). We posit that image schemas are best suited to elucidating the fact that light verbs are semantically related to their full verb equivalents but differ in their degree of abstractness (Tucker 2014). More specifically, full verbs typically express material and/or physical processes, whereas light verbs often express mental processes through metaphorization. Furthermore, the use of image schemas offers great potential for making the conceptual links between light verb constructions that exhibit different lexico-grammatical patterns but share the same conceptual base (Gradečak-Erdeljić 2009: 11–12). Establishing conceptual links has a decisive advantage for teaching: it allows the grouping of semantically and conceptually related constructions (Ellis et al. 2016: 300; Ruiz de Mendoza and Agustín-Llach 2016).

In what follows, we will present a linguistic analysis of light verb constructions in German that combines the use of image schemas (Oakley 2007) with insights from other cognitive linguistic approaches such as Construction Grammar (Goldberg 2006) and Cognitive Grammar (Langacker 2008). Furthermore, we will present a pedagogical process that uses multimedia animations in order to trigger the necessary bodily engagement for learning the embodied concepts underlying light verb constructions (Johnson-Glenberg et al. 2014). Both, the linguistic analysis and the respective pedagogical process will be limited to the three groups of light verb constructions that have been addressed in this study. It is also important to note that the concept-based approach does not aim to provide a comprehensive linguistic analysis and an exhaustive discussion of current issues regarding light verb constructions in German. Rather, it shows how cognitive linguistic notions can be applied to language learning and translated into effective classroom settings.

The first group of light verbs consists of all those constructions that are characterized as a caused motion construction (*X causes Y to move (in)to Z*, Goldberg 2006) using verbs such as *bringen* (to bring), *setzen/stellen* (to put)

and *ziehen* (to pull) (e. g. *jemanden in Verlegenheit bringen* 'to place someone in an embarrassing situation'*) and as an intransitive motion construction (*X moves (in)to Z*, Goldberg 1995) with the verbs *geraten* 'to get into' and *kommen* 'to come into' (e. g. *In Verlegenheit geraten* 'to get into an embarrassing situation'*). Both types of light verb constructions are semantically related to each other in that they describe emotions or mental activities (e. g. embarrassment, fear, etc.) as containers or regions, which individuals can get into, the underlying conceptual structure being the image schemas CONTAINER, REGION, PATH-GOAL, MOVEMENT (Oakley 2007). However, both types of light verb constructions make use of the image schemas differently: Whereas the caused motion construction describes an event where a patient Y is placed by an agent X into a target domain Z, the intransitive motion construction leaves out the source of energy (the agent X) and focuses on the mover (Y) that accesses the target domain. In fact, many light verb constructions that follow the caused motion pattern such as *in Verlegenheit bringen* 'to place someone in an embarrassing situation'*or *in Gefahr bringen* 'to place someone in a dangerous situation'*, have an equivalent in the form of an intransitive motion construction (*in Verlegenheit geraten* 'to get into an embarrassing situation'*, *in Gefahr geraten* 'to get into a dangerous situation'*). Thus, the description of both constructions as referring to two different but related events allows us not only to elucidate the meaning of the respective light verbs, but also to create conceptual links between the constructions and, at the same time, account for the differences between their respective lexico-grammatical patterns. However, with the aim of adapting such concept-based schemas to the learners' mindsets we use everyday life situations (so-called *pedagogical metaphors*, Roche and Suñer 2016) instead of more abstract symbols (graphical representations) such as circles and arrows. By doing so, learners can explore the conceptual motivation of light verb constructions through familiar symbols (Holme 2010: 362), i. e. through situations to which they can relate. As a consequence, they are able to create form-meaning pairings easily. Figure 1 shows how the light verb constructions *in Verlegenheit bringen* and *in Verlegenheit geraten* can be depicted as two related events within the experiential domain of sport. In fact, the visual form of embodiment in sport is expected to help cross-activate the semantic embodiment in language that often remains hidden to learners, as previous research has shown (Kanaplianik 2016, etc.).

The second group of light verb constructions includes ditransitive constructions (*X gives Z to Y*, Goldberg 2006) using the verb *geben* 'to give' (e. g. *jemandem die Erlaubnis geben* 'to give someone permission') on the one hand, and constructions using the verbs *erhalten/bekommen* 'to receive' on the other

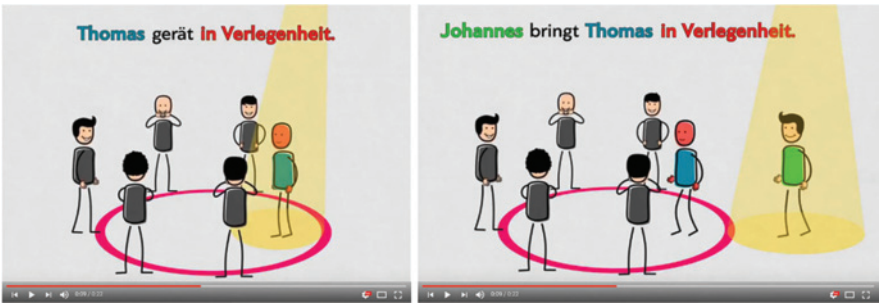

Figure 1: Screenshots of the animations for the light verb constructions *in Verlegenheit geraten* 'to get into an embarrassing situation'* and *in Verlegenheit bringen* 'to be placed in an embarrassing situation'*. The spotlight and the marked line illustrate the focus of the action and the target domain, respectively.

hand (*Y receives Z*; e. g. *die Erlaubnis erhalten* 'to receive permission'). The semantic relatedness of both constructions lies in their conceptualization of abstract concepts (e. g. ideas, advice, permission, etc.) as objects that we can receive or give to other people. Although both constructions make use of the same image schemas (OBJECT, REGION, TRANSFER OF POSSESSION, Oakley 2007; Langacker 2008), they differ substantially in their event construal: Ditransitive constructions with verbs such as *geben* describe the full transfer of possession event, with an object moving from the giver's dominion (sphere of control) into the receiver's dominion, while so-called benefactive constructions with the verbs *bekommen/erhalten* 'to receive/obtain' (Schierholz 2001) profile the physical and/or experiential aspects of accepting and controlling the object (Langacker 2008). Accordingly, both types of constructions exhibit different argument structures and, thus, different constraints regarding the participants. On the one hand, light verb constructions with the verb *geben* 'to give' appear as prototypical ditransitive constructions. This means that their verb valency and semantics require mentioning the giver, the object, and the receiver (cf. De Knop and Mollica 2016). On the other hand, the argument structure of light verb constructions using verbs such as *erhalten* and *bekommen* 'to receive' includes the receiver and the object, but does not require the giver to be mentioned. This can be achieved in the form of a prepositional object (e. g. *ich habe die Erlaubnis vom Dekan erhalten* 'I have obtained the permission from the dean'). Thus, both constructions allow us to present the participants of the event with varying salience, with the focus shifting from the giver (e. g. *the dean gives permission*) to the receiver in the second case (e. g. *We have gotten the permission*). As in the first group, the use of animations depicting concrete situations can make image-

Figure 2: Screenshots of the animations for the light verb constructions *einen Auftrag geben* 'to give an assignment' and *einen Auftrag erhalten* 'to get/receive an assignment'. The spotlight illustrates which participant is the focus of the action.

schematic concepts more transparent to learners without the need for specific linguistic terminology. Figure 2 shows how the action of giving someone an assignment is used to illustrate the focus shifting within the transfer of possession event performed by both constructions.

The third group of constructions comprises all those light verb constructions whose metaphorical meaning relies on the concept of verticality and, thus, uses the image schemas UP and DOWN as well as OBJECT (Oakley 2007). This group, however, differs substantially from the first two groups in that those light verb constructions exhibit a much higher degree of variation regarding their morphosyntactic realization. In fact, we included constructions that make use of both verbs and/or prepositions to evoke the concept of verticality. For example, light verb constructions such as *unter Beobachtung stehen* 'to be under observation' or *unter Einfluss stehen* 'to be under someone's influence' rely on the preposition *unter* 'under' which allows the linguistic realization of the conceptual metaphor UP IS CONTROL AND DOWN IS BEING UNDER CONTROL. Other light verb constructions in this group convey the same metaphorical meaning by means of verbs expressing an upward movement, such as *Protest erheben* 'to raise a protest'* and thus evoke a similar conceptual metaphor, UP IS POWER AND DOWN IS LACK OF POWER. Figure 3 shows how the visual embodiment of different sporting events can help elucidate the metaphorical meaning shared by different light verb constructions of the third group.

Taken together, the concept-based approach exploits the embodied nature of light verb constructions in order to provide learners with easy access to the conceptual motivation of grammar and, thus, support the creation of links between different constructions traditionally taught and learned as unrelated items. However, acknowledging that embodiment in language is usually not

Figure 3: Screenshots of the animation for the light verb construction *unter Beobachtung stehen* 'to be under observation'. The spotlight illustrates which participant is the focus of the action.

directly physical or visible, the approach relies on the visual embodiment of concrete situations (e. g. from the sport domain) that make the relevant image-schematic concepts more accessible to L2 learners. Bearing in mind the insights from embodied learning research reported in the previous section, we assume that multimedia animations are best suited for presenting linguistic and sensory-motor aspects in an integrated way, allowing for more accurate mental representations of the grammatical concepts.

4 Research questions

In light of the conclusions drawn from previous research, this study focuses on the following research questions related to the usefulness of embodied learning for teaching light verb constructions:

(1) To what extent does the use of a concept-based approach supplemented by animations support the learning of light verb constructions in L2-German?
(2) To what extent does the integration of bodily engagement in the form of animations influence the learners' beliefs about how grammar can best be learned?

This study will therefore not be limited to the observation of learning outcomes but will also consider individual learner variables, such as the learners' beliefs about grammar learning in order to gain deeper insights into the relationship between

cognitive and affective variables. In this context, learners' beliefs are described by Puchta (2010) as those subjective understandings of cause-effect relationships that influence our mental representations of the world and are thus crucial for explaining the effectiveness of classroom interventions (Horwitz 1987; Loewen et al. 2009).

5 The study

5.1 Participants

The participants of the study were thirty-nine learners of German as a foreign language with French as L1 (male $N = 16$, female $N = 23$; age $M = 22.3$), who were recruited from the Catholic University of Louvain (UCL) and the University of Mons (both in Belgium). The students were enrolled in the MA programs in Translation & Interpreting, Modern Languages, and Multilingual Communication during the 2017/18 academic year. The participants' language proficiency, which was assessed on the basis of the internal tests conducted in the respective programs and the participants' self-assessment, averaged C1 according to the Common European Framework of Reference (CEFR). However, as we asked the participants to indicate their language proficiency for the different language skills (speaking, reading, writing and listening), their level was rated, in some cases, slightly below or above the C1-level. The participants received an average of 30 hours of language instruction over the course of the academic year. In addition, they attended specialized seminars (translation, linguistics, communication sciences, etc.) that were mainly taught in the target language. As for the exposure to authentic L2 input, twenty-four students (61.5 %) stated that they had lived in a German-speaking country for at least three months, in most cases during a student exchange within the Erasmus mobility program and/or an internship.

5.2 Materials

The participants were divided into two groups according to the single-factor between-groups design of the study: In the first experimental group (EG), twenty students received a treatment based on the image-schematic approach to light verb constructions (see Section 3), while in the second experimental group (TG), nineteen students were presented with a more formalistic approach that focused on the argument structure of light verb constructions. Table 1 shows the different activities comprised in the teaching sequence carried out in both treatments. Both treatments were identical and used the same teaching materials except for activities 3 and 4.

Table 1: Overview of the activities planned for the treatments.

No.	Concept-based approach (EG)	Traditional approach (TG)
1	Guessing names of professions from given pictures and discussing learners' preferences.	
2	Reading a text about helpful strategies on how to successfully apply for a job; presenting 3 best strategies; identifying and discussing the functional meaning of light verb constructions in the text.	
3	Presentation of 2 groups of light verb constructions by means of multimedia animations, with the focus on the argument structure and the image-schematic content.	Presentation of 2 groups of light verb constructions, with the focus on the argument structure.
4	Drawing the image-schematic meaning of further light verb constructions from the same 2 groups. Introducing other groups of light verb constructions.	Describing and analyzing the argument structure of further light verb constructions from the same 2 groups. Introducing other groups of light verb constructions.
5	Fixed response exercises on the use of light verb constructions.	
6	Completing sentences in a job application cover using light verb constructions.	

Activities 1 and 2 set out to introduce the topic of the session and activate the learners' content schemas by brainstorming useful vocabulary (e. g. names of professions) and addressing the individual interests of the students (e. g. job preferences). In activity 2, the students were given an extract from an advisory booklet for job applicants that contained several authentic usages of the target structures. This activity represented a step-up from activity 1 in that it focused on both the content and the language and was designed to foster the awareness of the light verb constructions occurring in the text as well as of their functional meaning.

In activity 3, the students in the EG were presented with multimedia animations illustrating both the argument structure and the image-schematic content of the light verb constructions (see Figures 1–3). Although the presentation was carried out in teacher-fronted fashion, the key elements of the animations (e. g. the spotlight, the movement, etc.) were discussed with the whole class, allowing learner interaction to a certain extent. By contrast, the students in the TG were introduced to the different light verb constructions by means of a static multimedia presentation, with the focus exclusively on the argument structure and the respective syntactic features of light verb constructions. In activity 4, the students in both groups completed follow-up activities that were tailored to the respective teaching approaches from activity 3. The students in the EG completed tasks that were intended to foster the respective conceptualization processes by drawing the image-schematic meaning of light verb constructions in groups. Working in small

groups, the students wrote some sample sentences using the given light verb constructions and drew pictures illustrating their meaning. The other students had to guess the sentence on the basis of the picture and, in case of disagreement, discuss it with their peers until consensus was reached. This task was specially designed to support conceptualization processes and the negotiation of meaning, which is in line with the essential claims made by socio-cultural theory and concept-based instruction (Vygotsky 1986; Williams et al. 2013). It is worth noting that activities 3 and 4 were especially representative of a classroom setting that aims to trigger embodied learning by including low bodily engagement in concrete learning tasks (Johnson-Glenberg et al. 2014). By contrast, students in the TG performed tasks that focused on the analysis of the syntactic features of light verb constructions, while the semantic aspects were treated only with regard to the meaning of the words occurring in the sample sentences. Thus, the students adopted the teacher role and explained to their peers how the argument structure of the light verb constructions can be characterized from a syntactic point of view.

In activity 5, both groups were asked to complete exercises in the form of fill-in-the-gap texts, which were intended to facilitate practice of the target structures. In fact, in activity 6, the students were asked to write a paragraph for an incomplete cover letter in response to a genuine job vacancy, using some of the light verb constructions discussed previously. The treatment ended with a plenary presentation and a discussion of the various texts. Conducting the treatment took approximately 90 minutes in both groups.

It is important to note that, although the approaches differed substantially with regard to their theoretical foundations, the treatments in both groups were created and implemented according to the principles of task-based language teaching (Ellis 2009; Niemeier 2017). Acknowledging that grammar is essential for achieving a wide range of communicative purposes, the treatments aimed at fostering awareness and deep cognitive processing of the target structures as well as at using these structures in authentic communication (Niemeier 2017: 75; Tyler 2012).

5.3 Data collection procedures

In line with Purpura's (2004: 86) definition of grammatical ability "as the capacity to realize grammatical knowledge accurately and meaningfully in testing or other language-use situations", we described light verb constructions as symbolic structures that consist of formal, semantic and pragmatic elements (Croft 2007: 472). Accordingly, a test was developed that focused on knowledge about the constructional meaning, especially the contribution of the light verb to the overall meaning as well as its appropriate pragmatic use in order to convey

Table 2: Overview of the task types and test formats on the pre- and posttests.

Task type	Test format	Description	Dimensions tested
Fixed response	Cloze text	Fill-in the correct verb and/or preposition form in sentences	Formal aspects of elements of light verb constructions
Half open response	Reformulation task	Use light verb constructions to reformulate sentences with full verbs by conveying the original meaning	Semantic aspects of light verb constructions (perspectivation, agent defocusing, etc.)
Open response	Information gap task	Write a paragraph of an incomplete cover letter in response to a given job vacancy	Intended meaning and appropriate pragmatic use in written communication.

the intended meaning in special contexts of written communication (Reif 2012). Table 2 shows how these dimensions were covered by the different tasks in the test (based on Purpura 2004; Reif 2012).

Although the sentences in the first task were presented with a short context, they addressed topics directly relevant for the content discussed during the treatments. The 10 items of the task covered the different types of light verb constructions (see Section 3) in the same intensity. Furthermore, the items were randomly ordered in order to minimize possible measurement errors. The goal of the second task was to test to what extent learners were able to convey the same meaning using light verb constructions while adapting to the specific construal of the scene. In fact, using light verb constructions made it necessary, in many cases, to adapt the semantic roles due to specific constructional constraints, as shown in the following example:

(1) *[...] Leider ist es so, dass einem zu diesem Zeitpunkt nicht mehr einfällt oder die vielen Informationen einen leicht **verwirren**.*
'Unfortunately, at this point, nothing else comes to mind or the amount of information is rather confusing.'
*[...] Leider ist es so, dass einem zu diesem Zeitpunkt nicht mehr einfällt oder man durch die vielen Informationen in **Verwirrung gerät**.*
'Unfortunately, at this point, nothing else comes to mind or one gets confused by the amount of information'

In task 3, the participants were given five light verb constructions to be used in their linguistic production, but no constraints were imposed in terms of

the content other than to achieve the communicative purpose arising from the task. In this sense, the participants needed to make use of their linguistic and non-linguistic resources in order to convey the information requested in the job description and thus produce an appropriate communicative outcome.

The test was administered to the participants at three different points in time. Before the treatment, a pretest was conducted in order to assess their prior knowledge, while the learning outcomes were elicited by a posttest directly after the treatment as well as a delayed posttest three weeks later. In order to exclude score gains through retesting multiple items within a relatively short space of time, we created three versions of the test that were equivalent (task format, number of items, etc.) except for the fact that they tested different exemplars of each category of the light verb constructions that had been taught previously in the treatments. Cronbach's alpha was used to analyze the internal consistency reliability of the measures for the sample in the present study ($N = 39$), which was found to be very high ($\alpha = 0.822$). Although no time limit was set, completing the test took approximately 25 minutes. Before completing the test, the participants received a consent form and a cover letter, which explained the purpose of the study and guaranteed that confidentiality and anonymity would be maintained.

The participants also filled out a questionnaire on their experience with the teaching materials and activities as well as their perceptions of the importance of grammar in the context of language learning. More specifically, the participants were asked to rate the importance of memorizing rules and the usefulness of educational technology and images in learning grammar before and directly after the treatment in order to observe changes over time regarding the learners' beliefs about how grammar can best be learned.

5.4 Data analysis

The participants' answers were examined by two external raters in order to ensure consistency of data coding. Given the different formats of the tasks, we adopted different assessment procedures. For task 1 (gap filling), the answers were assessed by two independent raters using a sample answer sheet created on the basis of responses from native speakers. Given the fact that the native speakers answered many items differently, the external raters considered several options for the same items (e. g. *Die Erlaubnis bekommen/erhalten* 'to get/obtain/receive permission'). The external raters agreed on 92.6 % of the answers, which according to Cohen's kappa ($k = 0.814$, $p = 0.000$) indicates an excellent

interrater reliability. Disagreements were discussed until consensus on the final coding was reached.

In task 2 (reformulation task), two external raters assessed the answers regarding the appropriate use of light verb constructions in paraphrasing the sentences. They differentiated between three levels of correctness: Answers containing the light verb constructions with all required lexical units (e. g. noun, verb, and preposition) were credited with 2 points; answers containing a light verb construction with a false verb, noun, or preposition received 1 point; answers containing a light verb construction with two or more false lexical units received 0 points. All errors concerning verb conjugation or case-marking were not considered for the task assessment, since they were not explicitly covered in the treatments and were thus dealt with incidentally. The raters achieved 88 % agreement, which according to Cohen's kappa ($k = 0.819$, $p = 0.000$) indicates excellent agreement. In case of disagreement, discussion took place until consensus was reached.

In task 3, two independent raters judged the appropriateness of the light verb constructions used in the text according to aspects regarding the sentence level (e. g. argument structure) (50 %) and pragmatic aspects at the discourse level (topicalization, thematic progression, coherence) (50 %). Both raters were trained in advance with a subset of the sample in order to ensure consistency of judgements. The interrater reliability coefficient was calculated by a Pearson product-moment correlation, which indicated excellent agreement between the raters ($r = 0.966$, $p = 0.000$). The final coding consisted of the average score of the ratings (by-subject analysis).

Since the maximum scores for each task were different, we weighted them equally within the test, so participants could receive 5 points for each task and a maximum of 15 points for the whole test. In order to examine the effectiveness of the treatments, we carried out a one-way repeated measures analysis of covariance (ANCOVA) with Bonferroni correction for multiple testing. The within-subject factor was the time, i. e. the time-related change in the learning outcomes. The between-subject factor was the treatment (concept-based approach vs. traditional approach). The pretest measure was included in the model as covariate. As the groups achieved slightly different results on the posttest and the subjects were non-randomized, the use of ANCOVA was preferred in order to exclude the possibility of a systematic bias affecting interpretation of the learning outcomes in the posttest (Dimitrov and Rumrill 2003: 163). As for the analysis of learners' assessments of the usefulness of grammar, we calculated the change scores between the pretest and posttest and then analyzed the respective between-group differences by means of non-parametric Mann-Whitney U Tests.

6 Results

Table 3 shows the descriptive statistics of the test on light verb constructions expressed as mean scores by groups for the three measurement points.

Table 3: Mean scores in the pre- and posttests (overall and individual tasks).

	Pretest	Posttest	Delayed posttest
Concept-based approach (EG) (n=20)	$M = 10.98$	$M = 21.10$	$M = 17.15$
	$SD = 5.24$	$SD = 4.54$	$SD = 5.69$
Traditional approach (TG) (n=19)	$M = 9.87$	$M = 18.79$	$M = 13.29$
	$SD = 6.19$	$SD = 4.72$	$SD = 5.17$
Total (n=39)	$M = 10.44$	$M = 19.97$	$M = 15.27$
	$SD = 5.67$	$SD = 4.71$	$SD = 5.71$

Regarding the immediate posttest, an analysis of the mean scores revealed that both groups considerably improved their scores in the pretest, although the EG performed slightly better than the TG. By contrast, there was an overall decline in the learners' scores in the delayed posttest compared with the immediate posttest, while the difference between the groups increased. In fact, the EG outperformed the TG by just over 6 points. The ANCOVA revealed a significant *time* effect ($F(1, 36) = 5.439$, $p = 0.025$, $\eta 2 = 0.131$). Furthermore, an overall significant *group* effect was found ($F(1, 36) = 6.050$, $p = 0.019$, $\eta 2 = 0.114$). Post-hoc contrasts between the groups revealed significant differences for the delayed posttest ($p = 0.035$, 95 % CI [−0.256, −6.426], $\eta 2 = 0.118$), but no significant differences for the immediate posttest ($p = 0.131$, 95 % CI [−0.540, −4.012], $\eta 2 = 0.062$). This means that the treatment in the EG was more effective than the treatment in the TG only with regard to the long-term learning outcomes. Furthermore, the ANCOVA found no significant *time*group* interaction ($F(1, 36) = 0.893$, $p = 0.351$, $\eta 2 = 0.024$), which means that the changes from immediate posttest to delayed posttest in each group were identical.

The by-task analysis of the results revealed that the between-group differences did not hold for all dimensions included in the test (see Figure 4). In task 1, participants in both groups improved from the pretest to the immediate posttest to the same degree (EG $M = 2.700$; TG $M = 2.737$). However, the mean scores in the delayed posttest showed that the decline in performance for the TG ($M = -2.789$) was much more noticeable than for the EG ($M = -1.150$). The results from the ANCOVA revealed a significant *time* effect ($F(1, 36) = 7.882$,

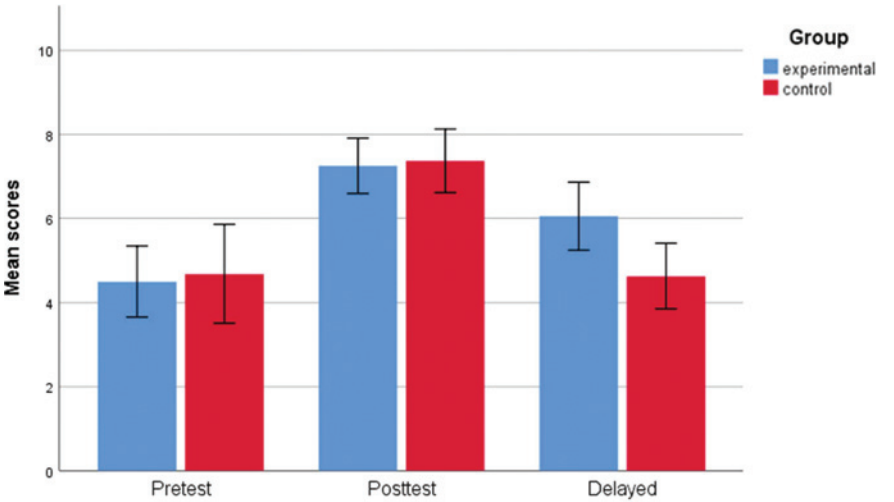

Figure 4: Mean scores for task 1 by group (EG vs. TG) and measurement time (pretest, posttest, and delayed posttest).

$p = 0.008$, $\eta 2 = 0.180$), but no significant *group* effect ($F(1, 36) = 3.209$, $p = 0.082$, $\eta 2 = 0.082$). As expected, the interaction *time*group* was found to be significant ($F(1, 36) = 6.633$, $p = 0.014$, $\eta 2 = 0.156$), which means that the changes from immediate posttest to delayed posttest within both groups were not identical.

Results in task 2 showed a different pattern, since participants improved from the pretest to both the immediate posttest (EG $M = 5.050$, TG $M = 4.263$) and the delayed posttest (EG $M = 3.050$, TG $M = 1.631$) to the same degree, so changes over time within the groups were comparable (see Figure 5). The ANCOVA found a significant *time* effect ($F(1, 36) = 8.174$, $p = 0.007$, $\eta 2 = 0.185$) and a significant *group* effect ($F(1, 36) = 11.413$, $p = 0.002$, $\eta 2 = 0.241$). The post hoc contrasts with Bonferroni adjustment revealed a significant between-group difference for the immediate posttest ($p = 0.022$, 95 % CI [0.168, 2.058], $\eta 2 = 0.137$) with a medium-sized effect, but no significant differences were observed for the delayed posttest ($p = 0.051$, 95 % CI [−0.005, 3.439], $\eta 2 = 0.102$).

In task 3, the participants' performance showed yet a different pattern. On the one hand, the participants in both groups improved from the pretest to both the immediate posttest (EG $M = 2.425$, TG $M = 1.921$) and the delayed posttest (EG $M = 1.625$, TG $M = 1.842$). On the other hand, the groups differed from each other in that the participants' performance in the EG between the posttest and delayed posttest slightly declined, while participants' performance in the TG remained

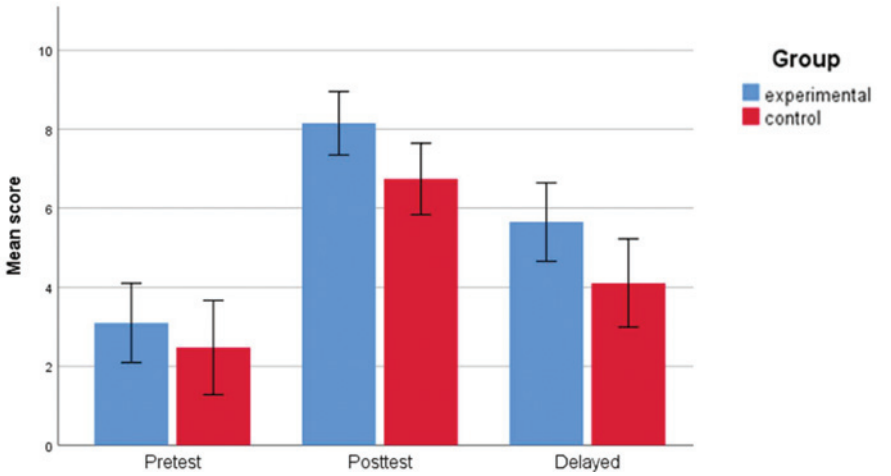

Figure 5: Mean scores for task 2 by group (EG vs. TG) and measurement time (pretest, posttest, and delayed posttest).

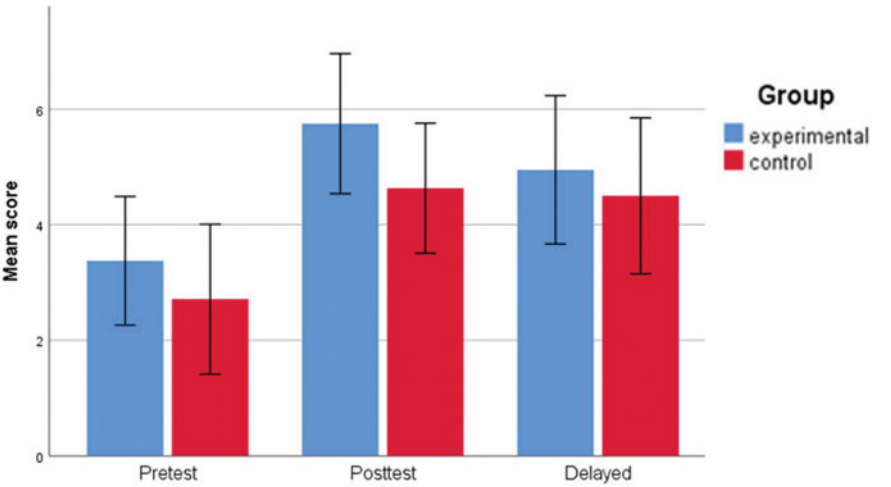

Figure 6: Mean scores for task 3 by group (EG vs. TG) and measurement time (pretest, posttest, and delayed posttest).

constant in both posttests (see also Figure 6). However, the ANCOVA did not find any significant *time* effect ($F(1, 36) = 0.534$, $p = 0.470$, $\eta 2 = 0.015$). Furthermore, no significant *group* effect ($F(1, 36) = 0.607$, $p = 0.441$, $\eta 2 = 0.017$) was found, after controlling for confounding effects due to between-group differences on

the pretest. The interaction *time*group* was not significant either ($F(1, 36) = 0.350$, $p = 0.558$, $\eta 2 = 0.010$).

Our next step was to analyze the change scores (M = posttest–pretest) of learners' assessments of how grammar can best be learned. Given the fact that the variable was categorical and not normally distributed, we used the nonparametric Mann-Whitney-U Test for the inferential analysis. Whereas the groups rated similarly regarding the importance accorded to memorizing grammar rules and using educational technology (memorization, $U = -0.673$, $p = 0.531$, $\eta^2 = 0.011$; technology $U = -0.575$, $p = 0.627$, $\eta^2 = 0.007$), their judgements regarding the usefulness of images in learning grammar differed significantly between the groups ($U = 2.568$, $p = 0.014$, $\eta^2 = 0.150$). In fact, the treatment in the EG substantially contributed to the positive attitudes developed by the participants towards image-supported grammar learning. Finally, we looked at how the participants in both groups perceived different aspects of the implementation of the respective treatments. The results revealed that the participants in the EG rated the usefulness of the teaching materials, i. e. the multimedia animations, and the follow-up activities significantly higher than their counterparts in the TG (teaching materials, $U = 2.357$, $p = 0.024$, $\eta^2 = 0.130$; activities, $U = 2.654$, $p = 0.011$, $\eta^2 = 0.164$). Although the way in which grammar was explained received on average better ratings by the EG, no significant differences were found between the groups ($U = 1.860$, $p = 0.084$, $\eta^2 = 0.075$).

7 Discussion

Two research questions were addressed in our study in order to substantially add to the understanding of how embodied learning approaches can be implemented in the context of language teaching. The first question asked whether embodied learning in the form of an image-schematic approach to light verb constructions supplemented by multimedia animations leads to better learning outcomes than a formalistic approach to light verb constructions. Overall, the results from the tests consistently showed that the students in the EG outperformed those in the TG, although only the between-group differences on the delayed posttest were found to be significant. This suggests that teaching approaches including low bodily engagement to illustrate the embodied nature and thus the conceptual motivation of light verb constructions are especially effective. There findings are in line with previous studies (e. g. Kanaplianik 2016; Scheller 2009) that used multimedia animations as a means to leveraging the effectiveness of image-schematic approaches and also, in a broader sense, with

those studies that report a positive impact of embodied learning (e. g. Glenberg et al. 2004; Ionescu and Ilie 2018; Pouw et al. 2016). However, it is important to note that the positive impact was not observable to the same extent for all tasks in the test. In fact, the by-task analysis revealed that the students working with the concept-based approach achieved much better results with respect to the semantic- and discourse-related aspects of light verb constructions than the students using the traditional approach. This suggests that getting access to the conceptual motivation of light verb constructions through bodily engagement helps not only in grasping the core meaning conveyed in a given sentence (*meaningfulness*, Purpura 2004: 16), but also in figuring out how light verb constructions can be applied to larger contexts of language production (*pragmatic appropriateness*, Purpura 2004: 16). Given the fact that no differences were found between the groups at the formal level, we can state that the concept-based approach provides added value only at those levels that are often neglected in more traditional, form-oriented approaches. Another aspect that would be worth exploring in future research is whether an increase in bodily engagement (cf. Skulmowski and Rey 2018) is accompanied by an increase in efficiency of the treatment (cf. Ionescu and Ilie 2018).

The second question concerned the learners' beliefs about how grammar can best be learned. The change scores showed that the greater importance accorded to images as a means of leveraging the learning of light verb constructions was much more evident in the EG than in the TG. Contrary to our expectations, judgements regarding the usefulness of educational technology and the importance of memorizing rules did not differ significantly across the groups, suggesting that there were no noteworthy changes over time. There might be some explanations for both findings: One the one hand, the relatively high ratings for the contribution of educational technology even before the treatment made it very difficult to observe any significant increase in the ratings after the treatment in both groups. It should also be mentioned that this aspect could have been worded more specifically (e. g. asking about different grammar learning tools rather than referring to educational technology as a homogeneous construct). In fact, previous research has shown that learners' perceptions might vary depending on the type of language learning technology (Golonka et al. 2014). On the other hand, the usefulness of memorizing rules in grammar learning seems to be a deeply entrenched belief of learners and was present to a certain extent in both groups. This is even more so for the students in the EG, since the concept-based approach puts forward the conceptualization processes and the conceptual links between constructions rather than their syntactic realization. This finding therefore suggests that these beliefs cannot be easily changed by such short-term pedagogical actions and might, in some cases, be

the reason why concept-based approaches to grammar teaching do not produce the expected added value in terms of learning outcomes (e. g. Bielak and Pawlak 2011). Overall, previous research calls for a more systematic application of cognitive linguistic notions to grammar teaching throughout the curricula and/or textbooks in order to further foster learners' acquaintance with concept-based approaches (Reif 2012; Tyler et al. 2011).

Although these findings are promising, further research could consider some of the limitations of this study in order to increase the effect of instruction and enhance its assessment. For instance, an additional experimental group working with the concept-based approach without animations would have produced a more differentiated view of the effect of the variables under investigation. To this end, the use of fully crossed factorial designs (2 x 2) with both the presentation mode (animation vs. static pictures) and the type of approach (concept-based vs. traditional approach) as independent variables is highly advisable (Kanaplianik 2016; Scheller 2009). Furthermore, it would also have been interesting to investigate whether the inclusion of interactive features in the animations, which is related to higher levels of bodily engagement (Johnson-Glenberg et al. 2014), would have contributed to even better learning outcomes. For instance, the animations could have been incorporated an interface that would allow learners to compose and display concrete scenes by themselves. By doing so, they could have experienced the relationship between the conceptualization processes and the environment in a more direct way. In other fields of educational research, the interaction with animations has already proven to be more efficient than just watching animations on the learning content (Dubé and McEwen 2015). Regarding the learners' beliefs about grammar learning, future intervention studies should consider carrying out treatments over a longer time interval in order to be able to observe more tangible changes in this regard. Furthermore, the questionnaires on the learners' beliefs could be supplemented by elicitation techniques such as HIMATT (Highly Integrative Model Assessment Technology & Test, Ifenthaler 2010) providing a more fine-grained assessment of changes in learners' mental models.

8 Conclusions

The aim of this study was to shed some light on the usefulness of bodily engagement in the form of animations for teaching embodied concepts of grammar. In line with previous research, our findings suggest that the use of multimedia animations has contributed to making the image-schematic

concepts underlying light verb constructions more transparent to learners. In more concrete terms, the animations have successfully triggered the bodily engagement needed for learning the dynamic aspects of the target constructions and the creation of more appropriate mental models. We also found that learners working with such materials significantly changed their beliefs about grammar learning, since the importance accorded to the use of image-based explanations after the treatment was considerably higher than for the group working with the traditional approach. However, the successfulness of such concept-based approaches supplemented by animations is subject to certain conditions (Niemeier 2017; Roche and Suñer 2016). First, learners should be able to easily relate the movement depicted in the animations to the respective dynamic aspects of the target constructions. This means not only that the approach needs to be well aligned with cognitive linguistic theory using embodied concepts for grammar description, but also that the materials used should ensure that perceptual processing corresponds to the cognitive requirements of mental model construction (Lowe and Schnotz 2014). Second, working with animations also needs to be accompanied by appropriate learning activities that support conceptualization processes and the negotiation of meaning according to socio-cultural theory and concept-based instruction (Vygotsky 1986; Williams et al. 2013). Finally, it is worth stressing the importance of considering the principles of task-based language teaching (Ellis 2009) when implementing such grammar teaching approaches. Accordingly, grammar should be treated as an essential element for achieving a wide range of communicative purposes, so interventions should aim to foster awareness and deep cognitive processing of the target structures as well as promote their use in a native-like way in relevant communication settings (Niemeier 2017: 75; Tyler 2012).

Acknowledgements: The authors would like to thank all participants and instructors in the study. We also acknowledge gratefully Katsiaryna El-Bouz, Françoise Gallez, and Manon Hermann for valuable comments.

References

Barsalou, Lawrence W. 1999. Perceptions of perceptual symbols. *Behavioral and Brain Sciences* 22(4). 637–660.

Beilock, Sian. 2015. *How the body knows its mind: The surprising power of the physical environment to influence how you think and feel*. New York, NY: Atria Books.

Bielak, Jakub & Mirosław Pawlak. 2011. Teaching English tense and aspect with the help of cognitive grammar: An empirical study. *Studies in Second Language Learning and Teaching* 1(3). 365–400.

Bielak, Jakub, Mirosław Pawlak & Anna Mystkowska-Wiertelak. 2013. Teaching the English active and passive voice with the help of cognitive grammar: An empirical study. *Studies in Second Language Learning and Teaching* 3(4). 581–619.

Clausner, Timothy & William Croft. 1999. Domains and image schemas. *Cognitive Linguistics* 10(1). 1–31.

Croft, William. 2007. Construction grammar. In Dirk Geeraerts & Hubert Cuyckens (eds.), *The Oxford handbook of cognitive linguistics*, 463–508. Oxford: Oxford University Press.

De Knop, Sabine & Fabio Mollica. 2016. A construction-based study of German ditransitive phraseologisms for language pedagogy. In Sabine De Knop & Gaëtanelle Gilquin (eds.), *Applied construction grammar* (Applications of cognitive linguistics; 32), 53–88. Berlin & Boston: Mouton de Gruyter.

Dimitrov, Dimiter M. & Phillip D. Rumrill. 2003. Pretest-posttest designs and measurement of change. *Work* 20(2). 159–165.

Driver, Paul. 2012. Pervasive games and mobile technologies for embodied language learning. *International Journal of Computer-Assisted Language Learning and Teaching* 2(4). 50–63.

Dubé, Adam K. & Rhonda McEwen. 2015. Do gestures matter? The implications of using touchscreen devices in mathematics instruction. *Learning and Instruction* 40. 89–98.

Ellis, Nick C., Ute Römer & Matthew B. O'Donnell. 2016. *Usage-based approaches to language acquisition and processing: Cognitive and corpus investigations of construction grammar*, Language Learning Monograph Series. West Sussex: Wiley-Blackwell.

Ellis, Rod. 2009. Task-based language teaching: Sorting out the misunderstandings. *International Journal of Applied Linguistics* 19(3). 221–246.

Evans, Vyvyan. 2012. Cognitive linguistics. *Wiley Interdisciplinary Reviews: Cognitive Science* 3(2). 129–141.

Gallagher, Shaun & Robb Lindgren. 2015. Enactive metaphors: Learning through full-body engagement. . *Educational Psychology Review* 27(3). 391–404.

Glenberg, Arthur M. 2010. Embodiment as a unifying perspective for psychology. *Wiley Interdisciplinary Reviews: Cognitive Science* 1. 586–596.

Glenberg, Arthur M., Tiana Gutierrez, Joel R. Levin, Sandra Japuntich & Micheal P. Kaschak. 2004. Activity and imagined activity can enhance young children's reading comprehension. *Journal of Educational Psychology* 96(3). 424–436.

Goldberg, Adele. 1995. *Constructions: A construction grammar approach to argument structure*. Chicago: University of Chicago Press.

Goldberg, Adele. 2006. *Constructions at work: The nature of generalization in language*. Oxford: Oxford University Press.

Golonka, Ewa M., Anita R. Bowles, Victor M. Frank, Dorna L. Richardson & Suzanne Freynik. 2014. Technologies for foreign language learning: A review of technology types and their effectiveness. *Computer Assisted Language Learning* 27(1). 70–105.

Gradečak-Erdeljić, Tanja. 2009. Iconicity of the verbal expression— The case of "light" verbs in English. In Mario Brdar, Marija Omazić & Visnja Pavičić (eds.), *Cognitive approaches to English: Fundamental, methodological, interdisciplinary and applied aspects*, 3–26. Newcastle upon Tyne: Cambridge Scholars Publishing.

Grass, Anja. 2013. Zur Veränderung mentaler Modelle beim Lernen mit Grammatikanimationen. *Zeitschrift Für Interkulturellen Fremdsprachenunterricht* 18(1). 62–71.

Holme, Randal. 2010. A construction grammar for the classroom. *International Review of Applied Linguistics in Language Teaching* 48(4). 355–377.
Horwitz, Elaine K. 1987. Surveying student beliefs about language teaming. In Anita L. Wenden & Joan Robin (eds.), *Learner strategies in language learning*, 119–132. London: Prentice Hall.
Hutto, Daniel D., Micheal D. Kirchhoff & Dor Abrahamson. 2015. The enactive roots of STEM: Rethinking educational design in mathematics. *Educational Psychology Review* 27(3). 371–389.
Ifenthaler, Dirk. 2010. Relational, structural and semantic analysis of graphical representations and concept maps. *Educational Technology Research and Development* 58(1). 81–97.
Ionescu, Thea & Adriana Ilie. 2018. Language learning in preschool children: An embodied learning account. *Early Child Development and Care* 188(1). 4–15.
Jacobsen, Natalia. 2018. The best of both worlds: Combining cognitive linguistics and pedagogic tasks to teach english conditionals. *Applied Linguistics* 39(5). 668–693.
Johnson-Glenberg, Mina C., David A. Birchfield, Lisa Tolentino & Tatyana Koziupa. 2014. Collaborative embodied learning in mixed reality motion-capture environments: Two science studies. *Journal of Educational Psychology* 106(1). 86–104.
Kanaplianik, Katsiaryna. 2016. *Kognitionslinguistische Animationen für die deutschen Modalverben. Zusammenspiel der kognitiven Linguistik und des multimedialen Lernens bei der Sprachvermittlung*. Berlin & Münster: Lit.
Kohl-Dietrich, Dorothee, Constanze Juchem-Grundmann & Wolfgang Schnotz. 2016. Conceptual Motivation as a tool for raising language awareness in the English as a foreign language classroom – Does it enhance learning outcomes? Insights from an empirical study. *Yearbook of the German cognitive linguistics association* 4(1). 193–209.
Langacker, Ronald W. 2008. *Essentials of cognitive grammar*. Oxford: Oxford University.
Lindgren, Robb. 2015. Getting into the cue: Embracing technology-facilitated body movements as a starting point for learning. In Victor R. Lee (ed.), *Learning technologies and the body: Integration and implementation in formal and informal learning environments*, 39–54. New York, NY: Routledge.
Lindgren, Robb & Mina Johnson-Glenberg. 2013. Emboldened by embodiment: Six precepts for research on embodied learning and mixed reality. *Educational Researcher* 42(8). 445–452.
Lindgren, Robb, Michael Tscholl, Shuai Wang & Emily Johnson. 2016. Enhancing learning and engagement through embodied interaction within a mixed reality simulation. *Computers & Education* 95. 174–187.
Loewen, Shawn, Shaofeng Li, Fei Fei, Amy Thompson, Kimi Nakatsukasa, Seognmee Ahn & Xiaoquing Chen. 2009. L2 learners' beliefs about grammar instruction and error correction. *Modern Language Journal* 93(1). 91–104.
Lowe, Richard K. & Jean-Michel Boucheix. 2016. Principled animation design improves comprehension of complex dynamics. *Learning and Instruction* 45. 72–84.
Lowe, Richard K. & Wolfgang Schnotz. 2014. Animation principles in multimedia learning. In Richard E. Mayer (ed.), *The Cambridge handbook of multimedia learning*, 513–546. New York: Cambridge University Press.
Mayer, Richard E. 2014. Cognitive theory of multimedia learning. In Richard E. Mayer (ed.), *The Cambridge handbook of multimedia learning*, 43–71. New York: Cambridge University Press.
Monaghan, James M. & John Clement. 1999. Use of a computer simulation to develop mental simulations for understanding relative motion concepts. *International Journal of Science Education* 21(9). 921–944.

Niemeier, Susanne. 2017. *Task-based grammar teaching of English: Where cognitive grammar and task-based Language teaching meet*. Tübingen: Narr.

Oakley, Tedd. 2007. Image schemas. In Dirk Geeraerts & Hubert Cuyckens (eds.), *The oxford handbook of cognitive linguistics*, 214–235. Oxford & New York: Oxford University Press.

Pouw, Wim T.J.L., Jacqueline A. de Nooijer, Tamara van Gog, Rolf A. Zwaan & Fred Paas. 2014. Toward a more embedded/extended perspective on the cognitive function of gestures. *Frontiers in Psychology* 5. 359.

Pouw, Wim T.J.L., Tamara van Gog, Rolf A. Zwaan & Fred Paas. 2016. Augmenting instructional animations with a body analogy to help children learn about physical systems. *Frontiers in Psychology* 7. 860.

Puchta, Herbert. 2010. Beyond materials, techniques and linguistic analyses: The role of motivation, beliefs and identity. *Puertas Abiertas* 6. http://www.herbertpuchta.com/page/handouts/Italy/Beliefs_Italy_Tour.pdf [Accessed on November 20, 2018].

Purpura, James E. 2004. *Assessing Grammar*. Cambridge: Cambridge University Press.

Reed, Stephen K. 2018. Combining physical, virtual, and mental actions and objects. Educational. *Psychology Review Volume* 30(3). 1091–1113.

Reif, Monika. 2012. *Making progress simpler? Applying cognitive grammar to tense-aspect teaching*. Frankfurt am Main: Peter Lang.

Roche, Jörg & Ferran Suñer. 2016. Metaphors and grammar teaching. *Yearbook of the German Cognitive Linguistics Association* 4(1). 89–112.

Roche, Jörg & Ferran Suñer. 2017. *Sprachenlernen und Kognition. Grundlagen einer kognitiven Sprachdidaktik*. Gunter Narr: Tübingen.

Ruiz de Mendoza Ibáñez, Francisco José & María del Pilar Agustín-Llach. 2016. Cognitive pedagogical grammar and meaning construction in L2. In Sabine De Knop & Gaëtanelle Gilquin (eds.), *Applied construction grammar* (Applications of Cognitive Linguistics 32), 151–184. Berlin & Boston: Mouton de Gruyter.

Scheller, Julia. 2009. *Animationen in der Grammatikvermittlung. Multimedialer Spracherwerb am Beispiel von Wechselpräpositionen*. Berlin & Münster: Lit Verlag.

Schierholz, Stefan. 2001. *Präpositionalattribute: Syntaktische und semantische analysen*. Tübingen: Niemeyer.

Shapiro, Lawrence. 2010. *Embodied cognition*. New York, NY: Routledge.

Skulmowski, Alexander, Simon Pradel, Tom Kühnert, Guido Brunnett & Günter D. Rey. 2016. Embodied learning using a tangible user interface: The effects of haptic perception and selective pointing on a spatial learning task. *Computers & Education* 92/93. 64–75.

Skulmowski, Alexander & Günter D. Rey. 2018. Embodied learning: Introducing a taxonomy based on bodily engagement and task integration. *Cognitive Research: Principles and Implications* 3(1). 6.

Sweller, John, Paul Ayres & Slava Kalyuga. 2011. *Cognitive load theory*. New York: Springer.

Tran, Cathy, Brandon Smith & Martin Buschkuehl. 2017. Support of mathematical thinking through embodied cognition: Nondigital and digital approaches. *Cognitive Research: Principles and Implications* 2(1). 16.

Tscholl, Michael & Robb Lindgren. 2014. Empowering digital interactions with real world conversation. *TechTrends* 58(1). 56–63.

Tucker, Gordon H. 2014. Giving it my best shot: Towards a coherent functional analysis of metaphorically-derived processes with particular attention to the 'light verb' expressions. In María de los Ángeles Gómez González, Francisco José Ruiz de Mendoza Ibáñez and

Francisco Gonzálvez-García (eds.), *Theory and Practice in Functional-Cognitive Space*. Studies in Functional and Structural Linguistics 68, 33–52. Amsterdam: John Benjamins.

Tyler, Andrea. 2008. Cognitive linguistics and second language instruction. In Peter Robinson & Nick C. Ellis (eds.), *Handbook of cognitive linguistics and second language acquisition*, 456–488. Mahwah, NJ: L. Erlbaum Associates.

Tyler, Andrea. 2012. Cognitive Linguistics and SLA. In Peter Robinson (ed.), *Routledge encyclopedia of second language acquisition*, 88–90. London & New York: Routledge.

Tyler, Andrea, Charles Mueller & Vu Ho. 2011. Applying cognitive linguistics to learning the semantics of English *to, for* and *at*: An experimental investigation. *Vial* 8. 181–205.

Vygotsky, Lev. 1986. *Thought and language*. Cambridge: MIT Press.

Weber, Heinz J. 1997. *Dependenzgrammatik: Ein Arbeitsbuch*. Tübingen: Narr.

Wik, Preben & Anna Hjalmarsson. 2009. Embodied conversational agents in computer assisted language learning. *Speech Communication* 51(10). 1024–1037.

Williams, Lawrence, Lee B. Abraham & Eduardo Negueruela-Azarola. 2013. Using concept-based instruction in the L2 classroom. *Perspectives from Current and Future Language Teachers Language Teaching Research* 17(3). 363–381.

Yasuda, Sachiko. 2010. Learning phrasal verbs through conceptual metaphors: A case of Japanese EFL learners. *Tesol Quarterly* 44(2). 250–273.

Yilmaz, Rabia M. 2016. Educational magic toys developed with augmented reality technology for early childhood education. *Computers in Human Behavior* 54. 240–248.

Yoon, Susan A., Emma Anderson, Joyce Lin & Karen Elinich. 2017. How augmented reality enables conceptual understanding of challenging science content. *Educational Technology & Society* 20(1). 156–168.

Yoon, Susan A., Karen Elinich, Joyce Wang, Christopher Steinmeier & Sean Tucker. 2012. Using augmented reality and knowledge-building scaffolds to improve learning in a science museum. *International Journal of Computer-Supported Collaborative Learning* 7(4). 519–541.