

Concept-based instruction for applied L2 acquisition

Systematic review

Julien Zakhia Doueïhi^{1,2,3} & Thomas François^{1,3}

¹ CENTAL, IL&C, UCLouvain | ² Fukuoka University | ³ TeAMM, IL&C, UCLouvain

This study's objective is to present an overview of experimental applications of Concept-Based Instruction (CBI) for Second Language Acquisition. CBI aims to describe complex grammatical notions in a thorough manner in order to facilitate their acquisition. Even though CBI is still considered as a recent domain in language teaching, the growing body of research makes it timely to present a systematic review, which is currently lacking. In the present paper, we will first describe the theoretical background upon which CBI is grounded. Then, we will carry out an analysis of 29 CBI studies in which a classroom experiment was performed, with the objective of considering the strengths and limits of this teaching method.

Keywords: CBI (concept-based instruction), SCT (socio-cultural theory), SLA (second language acquisition), CL (cognitive linguistics), mediation, research synthesis

1. Introduction

During this last decade of second language teaching research, concept-based instruction (CBI) has been increasingly promoted as a potentially effective methodology for the development of conceptual skills, especially for grammar-teaching purposes. This methodology gained popularity as L2 instructors realized that “[...] the quality of explanations provided to L2 learners [...] has a central impact on L2 development” (Williams et al., 2013, p.365). While there is general consensus on the effectiveness of communicative language teaching (CLT) methods to quickly enhance second language speaking skills (Richards, 2006), in the case of grammar and the more abstract aspects of linguistic development, the efficiency of such methodologies is more debatable. CLT, for example, frequently

leads to a lack of control over L2 grammatical skills after formal education (Lyster, 1999, 2004; Swain, 1997; Harley et al., 1990). For example, Lyster (2004) noticed that instruction overemphasizing production activities lead to difficulties for students in distinguishing the functionality of tenses, especially in the long-term.

Following these criticisms, a second language teaching methodology inspired by Vygotsky's socio-cultural theory (SCT) and called concept-based instruction (CBI) has been used in L2 instruction, supporting the use of explicit grammar instruction to enhance control over L2. CBI does not aim to replace CLT but could be seen as complementary to the production-focused methodologies. Essentially, CBI for second language acquisition (SLA) is based on the idea that increased explicit knowledge of difficult concepts (such as grammatical concepts, but also pragmatic, discursive concepts) can not only lead to the development of new cognitive structures, which enable a deeper understanding of the target concepts, but also to long-term acquisition (Lantolf et al., 2015; Ohta & Tsujihara, 2017). It also enhances learners' ability to use the concept, as opposed to the way traditional grammar teaching often explains concepts through incomplete rules of thumb (Negueruela, 2003; Garcia, 2017).

Experimental approaches to CBI are nearly all inspired by Vygotsky's widely known theory of education (1987), they have investigated the learning of different concepts, with the help of distinct methodologies and have returned mixed results. To our knowledge, no systematic review focused on CBI studies for SLA has been made. While we could find reports of previously performed CBI studies in several papers (especially in Lantolf et al., 2015; Kim, 2013), there was no specific intent to deliver an exhaustive list for the sake of systematicity. We also wished to produce an analysis including papers reporting both positive and mixed results in order to give a more faithful overview of the strengths and weaknesses of CBI. This is why we believe that a review of the literature in this promising field of research would not only arouse more interest for researchers in SLA, but would also give further insights into the methodologies used by CBI instructors and the expected benefits of such instruction when used in language instruction.

Our aim to determine the practical utility and degree of applicability of CBI in SLA lead us to focus our review on CBI studies which used a classroom intervention. In Section 2, we explore the theoretical background in which CBI is rooted. Section 3 describes the research methodology that helped us gather CBI studies. Section 4 is the focal point of this study offers an overview of studies analysed according to criteria described in the research methodology. Finally, in Section 5, we discuss some remaining challenges and promising avenues for research in the CBI field.

2. Theoretical framework

2.1 Vygotsky's socio-cultural theory of mind

According to Vygotsky's (1987) socio-cultural theory of mind, development – including learning – is conceptualized as a cognitive process mediated by cultural and social artefacts. In other words, cognitive development is derived from the interactive experience of the subject with the world. This is not to say that human neurobiology has no impact on development, but rather that it is mainly through interactivity that we grow and learn (Lantolf et al., 2015). While engaged with socio-cultural activities (interacting with an item or with other people, for instance), the human brain extends its conceptual layer; humans become able to intentionally control their biological functions – such as the ability to use the hand to hold an item, or the ability to recognize particular (Zhang, 2014). Vygotsky argues that humans grow into the intellectual life of those around them by learning from them, and consequently, that development is essentially a socially constructed process (Lantolf et al., 2015). This is why the help of another person is sometimes necessary – someone more knowledgeable regarding the problem we want to solve. One of the most effective ways of transmitting knowledge is thus achieved in formal education, where one plays the role of an instructor, and the other of a student.

Vygotsky (1987) hypothesizes that humans learn most efficiently in the Zone of Proximal Development (or ZPD). The ZPD can be understood as a learning phase situated between the state where a learner cannot solve a problem and the state where he/she can solve it without any help. This phase implies that tasks that learners normally cannot do without help can be achieved with enough assistance from an instructor. Connected to the importance given by Vygotsky to social interaction in the developmental process, the concept of ZPD asserts that while we can learn to some extent by experiencing the world's objects ourselves, it is less likely that mathematical concepts, for instance, can be learned without the aid of an instructor (Crain, 2010). In order to acquire a new complex process, the student should be helped in a way that his/her current knowledge allows to him/her to understand most of what is being taught, but still requires a further step in order to master the new concept – granted by the instructor's teaching. The ZPD, once crossed, then leads to a newly acquired developmental layer where the student is independent. Development becomes a progressive process where learners are continuously approaching their next abilities as they try to solve new problems (Lantolf et al., 2015).

Since we learn most complex concepts through the help of an instructor in an educational setting while using constructed forms of mediation to interact with

the world (language, for instance), we also gain access to what Vygotsky calls “scientific concepts”. Scientific concepts (as opposed to everyday concepts) are general concepts that are learned systematically and not through empiricism. As we begin to internalize these concepts, we become able to transfer their principles to any necessary context. The aim of school instruction is thus to gain control over those scientific concepts (Negueruela & Lantolf, 2006).

2.2 Concept-based instruction

The importance given to the knowledge of scientific concepts by SCT is one of the main tenets of concept-based instruction for second language teaching. According to CBI, most language teaching methods rely on the use of rules of thumb (such as: “*Spanish preterit should be used when an action was completed once in the past*”) to teach grammatical notions, but these rules lack the systematicity of scientific concepts (Garcia, 2017). This can lead to incorrect uses of the notions and overgeneralization and, as Pavlenko (1999) claims, while students can provide the definition of a grammatical concept, it does not mean they have control over its functionality. After asking his students to write arbitrary properties of two Spanish past tenses, Negueruela (2003) reported that in some cases, their definitions did not even match the examples they used to illustrate these properties. This shows that there might be a lack of control in how grammatical concepts are learned and perceived in traditional grammar instruction.

In a CBI classroom, the focus is shifted from memorizing rules to understanding the underlying concepts of an abstract grammatical notion. While this requires an exhaustive understanding of the grammatical notion and a dedicated teaching curriculum from the teacher, it also enables learners to mediate their own cognitive activity, and thus independently apply their new understanding to larger situations (Lantolf, 2011).

In order to promote teaching of scientific concepts in classroom instruction, Gal’perin (1989, 1992) devised a methodology called STI (“Systemic-theoretical instruction”). This model, one of the first CBI models applied to second language teaching and, more generally, formal instruction, follows a three-step procedure: materialization, verbalization, and internalization.

The *materialization* phase first aims to create a representation of the taught concept. Concretely, a visual representation such as a diagram or a graph is used to depict the concept in an exhaustive and systematic way, because Gal’perin believes an image has more impact on the students’ representations and is more easily grasped than a verbal definition. During this phase, the teacher must explicitly give access to the concept by explaining the constructed scheme, or SCOBA (Scheme of a Complete Orienting Basis of the Action). By understanding the

scheme, learners should have a better idea of how the concept works, and it should be designed so that any choice the student makes in the use of the grammatical concept is rationally motivated (Gal'perin, 1989). It is also extremely important for the taught concept to be as comprehensively presented as necessary. This step could be considered as a first scaffolding in the concept acquisition process that should eventually allow unmastered knowledge to be assimilated.

The *verbalization* phase then requires learners to explain the concept. This not only helps learners to verify their own understanding of the concept, but the activity itself is also a way of enhancing their ability to use the concept. From the teacher's perspective, this phase involves the monitoring of the verbalizations, whether they be made in a classroom or through homework recordings. Bringing concepts to consciousness by "linguaging" allows students to recontextualize the new conceptual knowledge to other contexts and enhance their overall control over the notion (Lee, 2016). Finally, the *internalization* phase is considered the objective of the whole sequence. Once the concept is internalized, it means learners are able to fully comprehend and apply the concept to any context without guidance of the SCOA.

While a few attempts to implement Gal'perin's theory in L2 instruction have been carried out (Carpay, 1974; Karpova, 1977), it was Negueruela (2003) who first extensively addressed STI to perform a CBI classroom study in everyday instruction. In order to teach Spanish verbal mood, tense, and aspect to L1 English/L2 Spanish learners, the researcher implemented interactive instruction based on in-class discussions, at-home audio-recorded verbalizations and the use of a flow-chart, which worked as the SCOA to explain the concepts. The aim of this study was to allow students to use these grammatical concepts according to their communicative intents rather than based on incomplete rules of thumb. The teaching methodology widely followed STI's main principles, with a strong focus on the importance of verbalization activities (6 at-home audio-recorded tasks were carried out) to internalize the studied concepts. The study demonstrated how students were able to make "coherent connections between accurate performance using preterit and imperfect and conceptualization of the meaning of preterit and imperfect through the notion of verbal aspect" (Negueruela, 2013, p. 235).

Following the success of Negueruela's work, several attempts to apply a similar concept-based grammar teaching methodology were carried out. These studies progressively made up the field of CBI for SLA. The growing body of research in this field makes it timely to give systematic reviews of the domain in order to facilitate experiments based on common tools. This is the reason why we aimed, in the present article, to gather and review all studies that intended to use a concept-based method for the acquisition of grammatical concepts within a classroom setting.

3. Research methodology

In order to provide the most exhaustive possible survey of studies about experimental Concept-based Instruction in SLA, we applied the principles used in *scoping reviews* (Kitchenham & Charters, 2007). These principles include three steps: (1) identifying relevant literature using a systematic search strategy; (2) selecting the corpus of studies based on inclusion and exclusion criteria and (3) extracting and coding variables for further analysis and interpretation.

In the first step, we carried out a systematic search based on common English keywords in the field of CBI for SLA in 5 meta-databases. The databases chosen were CAIRN, De Gruyter, ProQuest, MLA and ScienceDirect, and were all chosen for their relevance in the field of second language teaching. The keywords that we considered likely to address most of the studies we were looking for are: *Vygotsky / SCT / STI / CBI / "Concept-based instruction" / Concept / L2 / Second Language / FLE / ESL*.¹ We then performed several searches using combinations of two, three, or four of these keywords in the aforementioned databases via advanced searches. We obtained varied results, ranging from 6 studies to 3,502 studies. A manual investigation of the distributions of these results allowed us to pinpoint a set of best keywords to get the maximal number of hits related to SLA. The results for the five best sets obtained at the end of this manual analysis are displayed in Table 1.

While the combination of the keywords *Vygotsky / Concept / Second Language / ESL* returned the most hits, it was still not restrictive enough to cover faithfully the field of SLA CBI studies and also had the disadvantage of omitting studies performed with other languages as L2. We thus decided to focus on the second and third largest set of keywords, which were the combination of keywords *Vygotsky / Concept / Second Language OR L2 / SCT* (191 papers), and the combination of keywords *"Concept-based instruction" / Concept / Second Language OR L2* (136 papers).

As a second step, we analysed all the papers found in order to dismiss those which did not fall within the scope of our survey. In accordance with scoping review methodology, we relied on a set of inclusion and exclusion criteria. Inclusion criteria were that studies had to be about CBI. Secondly, CBI had to be applied to SLA. Finally, only studies conducted after 2003 were reviewed, as the field of CBI for SLA started to gain interest mostly after Negueruela's (2003) study. As regards exclusion criteria, we excluded articles written in languages we could not understand. As such, studies in English and French were included, while oth-

1. FLE stands for Français Langue Etrangère (French as foreign language); ESL stands for English as Second Language.

Table 1. Number of hits per keyword combination (restricted search)

Keywords combination	Database	De					Total number of hits
		Cairn	Gruyter	ProQuest	MLA	Science direct	
Vygotsky AND Concept AND (Second Language OR L2) AND CBI		0	22	31	6	14	73
Vygotsky AND Concept AND (Second Language OR L2) AND STI		0	5	25	1	16	47
Vygotsky AND Concept AND (Second Language OR L2) AND ESL		5	292	605	6	220	1128
Vygotsky AND Concept AND (Second Language OR L2) AND SCT		0	68	57	15	51	191
“Concept-based instruction” AND Concept AND (Second Language OR L2)		0	66	32	20	18	136

ers were excluded from our survey. Secondly, we excluded research which did not implement a classroom experiment, in order to better assess the effects and limitations proper to CBI. Application of the aforementioned criteria resulted in a corpus of 20 studies, distributed among the 5 databases as in Table 2:

This search in the databases allowed us to gather a solid corpus, but we went through an additional search step. It consisted of a manual investigation of the citation network of the 20 selected papers. This process was twofold: first, we used a forward citation search via Google Scholar to find more recent studies; then we carried out an ancestry citation search to find older articles. This led to inclusion of nine additional studies yielding a total of 29 studies published between 2003 and 2019. These studies were analysed according to the following coding scheme.

We identified three main dimensions to code: the context; the material analysed; and the experimental design. The exact scheme used to code for these dimensions is the following. The first dimension is concerned with the context of the study and covers the research duration and the study sample. The duration refers to the time interval between pre-test(s) and post-test(s) as well as, when mentioned in the studies, the frequency of the classroom sessions. The sample will also be described in terms of sample size and, for each study, the L1/L2 of the participants (in some cases, there are several L1s in the classroom).

Table 2. Studies distribution within the 5 databases

Studies	Cairn	De Gruyter	ProQuest	MLA	Science direct
Negueruela (2003)	∅	∅	∅	√	∅
Twyman et al. (2003)	∅	∅	√	∅	∅
Swain et al. (2009)	∅	√	∅	∅	∅
Ganem-Gutierrez (2011)	∅	√	√	√	∅
Garcia (2012)	∅	√	∅	√	∅
Lee (2012)	∅	∅	∅	√	∅
Van Compernelle (2012)	∅	√	∅	√	√
White (2012)	∅	√	∅	∅	∅
Kim (2013)	∅	√	∅	√	∅
Polizzi (2013)	∅	∅	∅	√	∅
Harun et al. (2014)	∅	∅	∅	∅	√
Zhang (2014)	∅	∅	∅	√	∅
Aguilo-Mora (2015)	∅	√	∅	∅	∅
Buescher & Strauss (2015)	∅	√	∅	∅	∅
Masuda & Labarca (2015)	∅	√	∅	∅	∅
Fehrmann (2016)	∅	√	√	∅	∅
Fogal (2016)	∅	∅	∅	√	∅
Williams (2016)	∅	√	∅	√	∅
Ohta & Tsujihara (2017)	∅	√	∅	∅	∅
Suñer & Roche (2019)	∅	√	∅	∅	∅

The first-dimension variables and values are: *Duration*: categorical (nominal) and numerical variable (course unit, day, week, semester, year). *Number of participants*: numerical variable. *Participant L1*: categorical (nominal) variable. *Participant L2*: categorical (nominal) variable.

The second dimension corresponds to the material analysed by the researchers/instructors, and includes the concepts taught as well as developmental data. Developmental data includes output variables that are closely linked to the instruction module, which is why most of them are in-class tasks. We used generic terms to sum up the wide variety of activities that were performed in class, while making distinctions between tasks of different nature (e.g. definitions *vs* compositions). This dimension gives information about the methodology used by the researchers/instructors in their attempt to use CBI in a classroom experiment. Second dimension variables and values are: *Aimed concept*: categorical (nominal)

variable. *Developmental data*: categorical (nominal) variable (i.e. definition, composition, written task, verbalization)

The third dimension describes the nature of the examination of the CBI module performed by the researcher. It includes the way the experimental design was established (within-subject design or between-subject design), whether statistical testing was performed (if no statistical testing was used, the alternative evaluation process will be mentioned) and what were the results. This last variable also codes whether a learning effect was observed at the end of the experiment, and whether that improvement was significant or not from a statistical point of view. Third dimension variables and values are: *Design*: categorical (nominal) variable (Repeated Manner (RM), Independent Groups Repeated Manner (IGRM)). *Statistical testing*: y/n + categorical (nominal) variable (in case of absence of statistics). *Improvement*: categorical (nominal) variable (no effect, no improvement, improvement, significant improvement).

- *No improvement*: pre- and post-test values compared without using a statistical test and reported no improvement;
- *No effect*: statistical testing conducted, but no effect detected;
- *Improvement* pre- and post-test values compared without using a statistical test and reported improvement;
- *Significant improvement*: statistical testing yielded a significant effect.

4. Overview of the studies carried out between 2003 and 2019

In this section, we present the results of our systematic analysis based on a corpus of 29 CBI studies, published between 2003 and 2019. The analysis is based on the coding of various characteristics of these studies, grouped according to the aforementioned three dimensions. For each dimension, a table containing the coded characteristics of all studies is reported (the studies are presented by chronological order) and we discuss the most important elements emerging from our analysis.

CBI experiments conducted between 2003 and 2019 in second language classroom environment range from a single session (intensive classroom lesson carried out by Suñer & Roche, 2019) to a whole year (developmental case study conducted by Polizzi, 2013). There seems to be no common ground to whether a CBI module should be carried out in the short-term or in long-term, although it is important to note that many researchers stated a longitudinal study would be beneficial after conducting their experiment, even when results were positive (Lai, 2012; Frazier, 2013; Ord, 2014; Buescher & Strauss, 2015; Williams, 2016). In some studies (Twyman et al., 2003; Harun et al., 2014; Aguilo-Mora, 2015), the study duration was not mentioned.

Table 3. Study context

Research	Duration (frequency)	Context		
		Participants	L1	L2
Negueruela (2003)	16 weeks	12	English	Spanish
Twyman et al. (2003)	1 course unit	34	Spanish	English
Ferreira (2005)	16 weeks	14	7 diff. languages	English
Yanez-Prieto (2008)	1 semester	14	English	Spanish
Thorne et al. (2008)	1 semester	118	Several diff. langu.	English
Serrano-Lopez & Poehner (2008)	3 weeks	80	English	Spanish
Swain et al. (2009)	1 week	10	English	French
Ganem-Gutierrez (2011)	2 days	6	Arabic, Thai	English
Van Compernelle (2012)	6 weeks	8	English	French
Garcia (2012)	12 weeks	32	English	Spanish
Lee (2012)	6 weeks (1x/week)	23	Chinese, Korean, Thai	English
Lai (2012)	8 weeks (5x/week)	16	English	Chinese
White (2012)	7 weeks	30	7 diff. languages	English
Kim (2013)	12 weeks	9	Korean	English
Frazier (2013)	1 semester (2x/week)	6	English	Spanish
Polizzi (2013)	1 year	1	Ukra., Russ., English	Spanish
Harun et al. (2014)	1 course unit	8	Malay	English
Ord (2014)	7 weeks	5	English	French
Zhang (2014)	2 weeks	6	English	Chinese
Buescher & Strauss (2015)	2 days – 3h total	8	English	French
Aguilo-Mora (2015)	1 course unit	20 (14 + 6)*	English/Spanish	Spanish/English
Masuda & Labarca (2015)	1 week	8	English	Japanese
Renoud (2016)	21 weeks – first exp	7	Japanese	French
Renoud (2016)	12 weeks – sec. exp	5	Japanese	French
Williams (2016)	1 day	12	English	French
Fehrmann (2016)	4 weeks	10	Japanese	German
Fogal (2016)	8 weeks – 16h total	7	Japanese	English
Fazilatfar et al. (2017)	8 weeks (1x/week)	28	Iranian	English
Ohta & Tsujihara (2017)	8 weeks	12	English	Japanese
Suñer & Roche (2019)	One 1h30 session	39	French	German

* Aguilo-Mora (2015) performed an experiment in 2 classrooms in parallel, one with 14 students learning Spanish as L2 and the other one with 6 students learning English as L2.

The classroom session frequency is also a factor that must be considered. While most of the research took place instead of the regular language lesson, some experiments were intensive and extended the duration of the curricular lesson (Lai, 2012; Williams, 2016). It is yet to be determined whether classes should be given extensively over a short period of time, or if there are merits in leaving enough time between each lesson for students' memories to internalize.

The number of participants is also highly variable, ranging from a single student (Polizzi, 2013) to 118 students (Thorne et al., 2008). Out of the 29 studies reviewed, 6 were carried out with over 30 students, and 14 were conducted with 10 students or less. These numbers are in line with the general mean of students in between-subject designs in classroom experiments of 24.6 (Lindstromberg, 2016).

A review of participants' target language shows that among the 29 studies reviewed, 11 were conducted with students learning English as an L2, 7 learning Spanish, 6 French, 2 German, 2 Japanese, and 2 Chinese. As regards student's L1, English dominated (L1 of participants in 16 of 29), most likely due to the fact that most of these studies were carried out in North America. Japanese and Korean are also moderately represented as each is the L1 of learners in 3 studies. Spanish and Thai are each represented in 2 studies. It is worth mentioning that 6 studies were performed in classes with mixed L1 backgrounds, in which case, the teaching intervention was entirely carried out in the learners' L2.

The analysis of the concepts that were targeted by each study shows a clear trend towards the teaching of aspectual properties: out of the 29 studies reviewed, 10 studies focused on aspect. This might come from the fact that Negueruela's seminal study aimed to teach Spanish aspect. Aspect is also widely acknowledged as a difficult grammatical concept to acquire, especially in a teaching context where there are inadequacies in the way grammatical explanations of aspect are presented in textbooks (Negueruela & Lantolf, 2006).

Another interesting category of concepts that was researched are tied to spatial properties, such as locative prepositions (2 studies) and, to some extent, phrasal verbs (2 studies). In that regard, Serrano-Lopez & Poehner's (2008) attempt to allow learners to internalize locative prepositions referring to spatial concepts was especially innovative, as the researchers turned their teaching module into a practice session with 3D clay models.

Besides grammatical concepts, some researchers applied a concept-based method to concepts linked to other linguistic categories, such as pragmatics (distinction between French forms of address by Van Compernelle, 2012; sarcasm by Kim, 2013; topicalization by Zhang, 2014; honorific speech by Ohta & Tsujihara, 2017). There is also a case where a purely semantic concept was studied (the concept of civilizations, see Twyman et al., 2003). There seems to be no particular constraint with carrying out a CBI with concepts that are not purely grammatical.

Table 4. Study material

Research	Material	
	Aimed concept	Developmental data
Negueruela (2003)	Aspect, mood, time	Definitions, in-class performances, individual recordings
Twyman et al. (2003)	Civilizations	Compositions, quiz, MCQ, map creations, essays
Ferreira (2005)	Writing genres	In-class performances, in-class interactions, problem-solving tasks
Yanez-Prieto (2008)	Aspect, time, textual properties	In-class performances, compositions (3), interviews (2)
Thorne et al. (2008)	Deontics, directive speech	Roleplay, performances, interviews, corpuses
Serrano-Lopez & Poehner (2008)	Locative prepositions: <i>de, en, a</i>	Written tasks, verbalizations
Swain et al. (2009)	Voice	Definitions, writing tasks, individual recordings
Ganem-Gutierrez (2011)	Aspect	Definitions, written tasks (exercises), oral verbalizations (in pairs)
Van Compernelle (2012)	Sociopragmatics	Interviews (6), questionnaires, scenarios
Garcia (2012)	Aspect	Definitions, in-class performances, individual recordings
Lee (2012)	Phrasal verbs: <i>out, up, over</i>	Definitions, compositions, verbalizations, MCQ, interviews
Lai (2012)	Temporal system, aspect markers	Definitions, in-class performances, compositions, dialogues, translations
White (2012)	Phrasal verbs: <i>up, out, through, off, down, in</i>	Definitions, written tasks (explaining meaning), drawings, verbalizations (disc.)
Kim (2013)	Sarcasm	Interviews, in-class performances, compositions
Frazier (2013)	Verbal mood	Definitions, written and oral tasks (compositions, recordings)
Polizzi (2013)	Aspect	In-class performances, verbalizations, interviews

Table 4. (continued)

Research	Material	
	Aimed concept	Developmental data
Harun et al. (2014)	Aspect, time	Verbalizations (language units)
Ord (2014)	Aspect	Interviews (3), written and oral tasks, discussions
Zhang (2014)	Topicalization	Definitions, compositions, in-class performances
Buescher & Strauss (2015)	Locative prepositions: <i>à, dans, en</i>	Written tasks, compositions, discussions/verbalizations
Aguilo-Mora (2015)	Motion verbs	Written tasks (translations), oral tasks (giving directions), verbalizations
Masuda & Labarca (2015)	Particles <i>ni, de</i>	Written tasks (narratives), definitions, verbalizations
Renoud (2016)	Aspect, time	Definitions, written tasks, compositions, individual recordings
Williams (2016)	Auxiliary verbs	Written tasks (auxiliaries choice), verbalizations (Chatzy platform)
Fehrmann (2016)	Declarative sentences: prefield (V2 structure)	Written tasks (writing mails), verbalizations, in-class performances
Fogal (2016)	Academic writing: stylistics, voice	Written tasks (essays, stylistic worksheets), recorded discussions, interviews
Fazilatfar et al. (2017)	Aspect, time	Definitions, compositions, multiple-choice questions, verbalizations (written)
Ohta & Tsujihara (2017)	Honorific speech (<i>wakimae</i>)	Roleplay, written tasks, individual recordings, online surveys, discussions
Suñer & Roche (2019)	Light-verb constructions	Written tasks (fill-the-gaps, reformulations, cover letter)

In order to gather developmental data from their experiments, researchers mostly adopted the three following teaching strategies. The most common way was a definition task, in which students must explain the concept. Most researchers resorted to this task either directly during interviews or through a written task. Another commonly used process was the recordings of students' verbalization. Finally, one of the most indicative markers of improvements in concept acquisition consisted in performance data obtained through the use of in-class direct observation.

Table 5. Experimental design

Research	Experimental design		
	Design	Statistical testing	Results
Negueruela (2003)	RM	No (qualitative analysis of definitions and discourse)	Improvement
Twyman et al. (2003)	IGRM	Yes	Significant improvement
Ferreira (2005)	RM	Yes	Significant improvement
Yanez-Prieto (2008)	RM	No (test score contrastive analysis)	Improvement
Thorne et al. (2008)	RM	No (correct usage rate comparison)	Improvement
Serrano-Lopez & Poehner (2008)	IGRM	No (test score contrastive analysis)	Improvement
Swain et al. (2009)	RM	Yes	Significant improvement
Ganem-Gutierrez (2011)	RM	No (test score contrastive analysis)	Improvement
Van Compernelle (2012)	RM	Yes	Significant improvement
Garcia (2012)	RM	No (qualitative analysis of definitions)	Improvement
Lee (2012)	RM	Yes	Significant improvement
Lai (2012)	IGRM	Yes	Significant improvement
White (2012)	RM	Yes	No effect
Kim (2013)	RM	Yes	Significant improvement
Frazier (2013)	RM	No (test score contrastive analysis)	Improvement
Polizzi (2013)	RM	Yes	Significant improvement
Harun et al. (2014)	RM	Yes	Significant improvement
Ord (2014)	RM	Yes	Significant improvement

Table 5. (continued)

Research	Experimental design		Results
	Design	Statistical testing	
Zhang (2014)	RM	Yes	Significant improvement
Buescher & Strauss (2015)	RM	Yes	Significant improvement
Agüilo-Mora (2015)	RM	No (qualitative analysis of the correctness of translations)	No improvement
Masuda & Labarca (2015)	RM	Yes	Significant improvement
Renoud (2016)	RM	Yes	Significant improvement
Williams (2016)	RM	Yes	Significant improvement
Fehrman (2016)	IGRM	Yes	Significant improvement
Fogal (2016)	IGRM	Yes	No effect
Fazilatfar et al. (2017)	IGRM	Yes	Significant improvement
Ohta & Tsujihara (2017)	RM	No (qualitative analysis of the correct understanding of the concept)	Improvement
Suñer & Roche (2019)	Igrm	Yes	Significant improvement

The experimental design of CBI studies is also a key characteristic as it is a clue about the confidence one can have in the results reported in the study. Two types of experimental designs were used: repeated manner (RM) and independent groups with repeated manner (IGRM). RM designs measure the effects of the training at different times within the same group, while IGRM designs not only measure effects of CBI training as the difference between post-experimental performance and pre-experimental performance, but they also compare this performance with that of a comparison group. We found 7 studies carrying out an IGRM design, the other 22 had no comparison group.

The 7 studies using IGRM design compared the CBI group with a comparison group taught following a traditional approach. Among them, 3 studies stand out as they performed a multidimensional design (having more than one comparison group as a basis of comparison) that could be inspiring for future research in

the field. Serrano-Lopez & Poehner (2008) investigated the impact of the nature of the CBI modules through an experiment with three groups: a CBI module including use of 3D clay models as a visual tool, a CBI module without the use of clay, and a traditional communicative approach module. Lai (2012) compared the effects of a CBI module on elementary-level students with two comparison groups receiving traditional teaching: one of elementary-level students and one with intermediate students. This design helped to better characterize the conceptual development in the experimental group compared to similar and more advanced learners. Going further on this track, Fehrmann (2016) tested the effects of a CBI module for German L2 in comparison with a comparison group of learners receiving no CBI, but also with a comparison group composed of native German speakers, representing the mastery native speakers have of the concept.

Twenty studies carried out statistical testing. In cases where no statistical testing was performed, the researchers used various methods in order to analyse the data, resorting to using purely qualitative analysis (4 studies) or comparing test scores of the samples without using a statistical test to generalize (5 studies).

The last issue we address is the effectiveness of the CBI approach in terms of conceptual development. Most studies (26 out of 29) show, at various degrees, overall improvements in the conceptual knowledge and understanding of the target concept. It is interesting to note that the majority of the studies where results were statistically tested showed significant improvements in the conceptual development, with only 2 studies reporting no effect of CBI. Calculations of Cohen's *d* effect sizes demonstrate significant effect within CBI groups, with magnitudes from pre- and post-tests comparison as high as 0.58 (Fazilatfar et al., 2017), 0.67 (Lee, 2012), 1.12 (Suñer & Roche, 2019) or even 2.15² (Kim, 2013).

The studies where developmental data was analysed qualitatively and/or without statistical testing also reported improvement, apart from Aguilo-Mora's study (2015). Among the two other studies reporting no effect, White (2012) notes that the results he obtained with the method were not significant. Likewise, Fogal (2016) reports no differences between groups and slight to moderate effects in the long term.

It is noteworthy that Serrano-Lopez & Poehner (2008), Lai (2012), and Fehrmann (2016) all reported positive results from their multidimensional studies. Serrano-Lopez & Poehner's module showed that the CBI+clay condition outperformed the two other groups, especially in the long term. In Lai's study, the experimental group not only performed better as regards concept mastery than the comparison group with the same initial level, but also performed no differ-

2. This could be explained by the fact that the difference in results found in pre-test were important and by the low number of participants ($n=9$)

ently than the more proficiency intermediate level comparison group. Fehrmann (2016) also reports positive effects of the CBI module, which allowed learners to reach levels of understanding of the concept close to that exhibited by L1 German speakers. The latter experiments suggest that CBI instruction could have a stronger effect than other teaching methods on the conceptual knowledge of learners.

It is important to note that although results were generally positive, researchers should still consider these results with caution as experiments with CBI can lead to mixed results (as seen in 3 studies reviewed in this paper). Furthermore, the field could also be subject to publication bias. As such, publications with negative results could have been more difficult to identify or might not have been published at all.

5. Challenges and avenues for future research

The overview of the CBI field of research sheds light on the current state of development of the domain. Ever since the core study performed by Negueruela (2003), STI-inspired concept-based pedagogy has grown in popularity, and has essentially focused on an alternative way to teach complex grammatical concepts whose acquisition is often hampered by traditional instruction manuals that generally explain grammatical concepts using rules-of-thumb.

Although most previous studies generally bear witness to the success of CBI in SLA grammar acquisition, it is still hard to say whether the method itself could become standard in L2 curricula. Current limitations of CBI should be balanced against the potential benefits granted by a conceptual approach in L2 acquisition. A major concern comes from the fact that only a minority of the reviewed studies (around 24%) included a comparison group. It is therefore hard to judge whether CBI is more effective than a traditional method. Additionally, several researchers argued that longitudinal studies should be more frequent as they would allow deeper research and enable the observation of more data (Swain et al., 2009; Frazier, 2013; Ord, 2014; Buescher & Strauss, 2015; Masuda & Labarca, 2015; Williams, 2016). Third, the limited sample sizes used in most studies raise concerns about the generalizability of the results. Even when statistical tests were performed, experiments were often carried out in classes with a number of students ranging between 10 and 30, which could be considered insufficient for statistical reliability. A solution could be to carry out several replication studies and combine their effect sizes through a meta-analysis, to get a more reliable estimator of CBI effect size.

Another concern comes from the fact that creating SCOBAs to materialize complex grammatical knowledge is not an easy task. As Fogal (2016, p.180) noted after his experiments, CBI “raises questions about the effectiveness of [SC]OBAs – either because they may be poorly-conceived or because learners do not perceive their (intended) effect – for concept development.” Additional guidance for the instructors seems to be required, as, ideally, the knowledge of the target concept should be deep enough to construct relevant SCOBAs. While in principle, any concept could be materialized, it is worth noting that the more complex a concept is, the heavier the cognitive load required for students and the deeper the degree of involvement with the target concept will be. Given that CBI tries to explain the concepts thoroughly, it involves a huge investment of time and energy for teachers and students to learn a specific concept, which can potentially lead to a slowdown in curriculum advancement.

Bearing these limitations in mind, several axes could be investigated in future research. First, in order to give credit to the CBI method, the solid SCT/STI theoretical basis that sustains it should be supported by instruction manuals, provided these manuals are based on SCOBAs. While SCOBAs are by nature adapted to each concept they should describe, their construction is often similar (a graph or diagram of all iterations of a given concept). A more thorough, explicit treatment would probably benefit learners who would want to dive deeper into their second language, and we believe that this is something SCOBAs can provide. However, in order to create such manuals, SCOBAs must have been tested and their systematic efficiency should have been demonstrated.

Another key to the potential success of CBI would come from the use of new technologies. Serrano-Lopez & Poehner (2008) took advantage of technology to provide 3D modelling using clay as physical support, while Suñer & Roche (2019) made use of multimedia animations to show the uses of light-verb constructions.³ In both cases, the use of these new supports proved their usefulness as the results were, in the long-term, better for the experimental group than for the comparison group. Further uses of digital technologies, in particular virtual environments, could yield more interactive SCOBAs, and also be easier to share. Allowing learners to suggest their own conceptual mapping through a MOOC or an app could not only lead them to train their understanding as part of verbalization, but also allow other learners to react and offer their own vision of the concept in the process. Additionally, digital data also has the advantage of being easier to gather, allowing for quicker collection of results.

3. Light-verbs are, in German, verbs that do not have a strong intrinsic meaning and work together with another expression, e.g. *nehmen* in *Angriff nehmen* (lit. *to take attack*, meaning “to attack”).

Strengthening the links between CBI and the field of Cognitive Linguistics (CL) might also have positive impacts on the domain. As Ellis & Robinson (2008, p.7) asserted, “[...] some aspects of an L2 require awareness and/or attention to language form – implicit learning is not sufficient for successful SLA [...]”. In CL theories, linguistic knowledge is seen as a part of global cognition and can be learned through the development of categories. Categories can be seen as networks of concepts that humans create progressively and that allow us to relate to more and more difficult meaning-demanding tasks. Consequently, meaning is seen as the key to linguistic development, and explicit language teaching is not seen as redundant, a view shared by the SCT and CBI. In that regard, Lantolf (2011) argues that CL can notably play a role in the initial phase of CBI, the materialization phase: just as categories in CL are materialized through visual representations and schemes, concepts in CBI take the form of SCOBAs. Using theories of categorization might prove to be useful in the creation of adequate SCOBAs.

CL also argues that cognition is embodied. This means that concepts, categories, reasoning, and judgment are all connected to certain parts of the body – mostly the neural structure (Borghi, 2010). This view is shared by neuroscientists who showed that sensory structures of the brain are connected to more abstract mental functions such as consciousness, emotion, self-awareness, and will (Damasio, 1999; Edelman, 2004). While SCT is mostly focused on the social component of development, it does not exclude the impact of neurobiology, and uncovering the effects of embodiment and how conceptualization is performed in the brain might be useful in order to create effective SCOBAs. It could indeed be possible to deliver the most efficient forms of conceptualization tools (as we could see, for instance, that visual representations often had better long-term effects and deeper understanding in CBI experiments).

6. Conclusion

In this review, we first aimed to summarise the theories informing CBI. This method asserts that efficient explicit instruction combined with verbalization exercises can lead to better control over a given concept, should it be grammatical, pragmatic or even paralinguistic. In the methodology section, we used the scoping review paradigm to gather as many studies reporting a classroom experiment using CBI in SLA as we could find, namely 29. These papers were then manually analysed along 3 meaningful dimensions that includes several variables that we coded for each study. Finally, possible contributions and limitations of CBI were mentioned in a discussion following the analysis of the papers.

Although we took care to choose as relevant keywords as possible to build our corpus of studies, we might have overlooked a few studies, especially studies with mixed or negative results that might not be very visible in the databases. Nonetheless, readers should still be aware of the growing popularity of CBI and the encouraging results reported by some of the most thorough studies (Serrano-Lopez & Poehner, 2008; Lai, 2012; Fehrmann, 2016). We strongly believe that the field would benefit from further research development, including the application of CBI to new concepts, experiments comparing the effectiveness of an L1-based explicit instruction versus L2, as well as research addressing difficult concepts in other languages. The positive results that were globally obtained in current CBI studies are highly promising as most experiments have proven that effective conceptualization activities could improve control over complex grammatical or pragmatical concepts in a significant way.

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Address for correspondence

Julien Zakhia Doueihy
CENTAL, IL&C, UCLouvain
Place Montesquieu, 3
bte L2.06.04
B-1348 Louvain-la-Neuve
Belgium
julien.zakhia@uclouvain.be
 <https://orcid.org/0000-0002-8306-184X>

Co-author information

Thomas François
TeAMM, IL&C, UCLouvain
thomas.francois@uclouvain.be

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