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A Morpho-Semantic Digital Didactic Dictionary for Learners of Latin at Early Stages

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Abstract

Diccionario Didáctico Digital de Latin (Digital Didactic Dictionary for Latin) is an open-access lexicographic work, created and hosted by the Universidad Complutense de Madrid. It is a bilingual dictionary (Latin-Spanish) that faces the challenge of providing Spanish-speaking students of Latin with an innovative lexicographic tool that facilitates the learning of basic Latin. Based on the theoretical principles of valences described in Tesnière's Dependency Grammar, Lyons' ontologies, and Fillmore's theory of semantic frameworks, the dictionary has been conceived as a linguistic tool to understand how Latin works at the semantic, morphological, and syntactic levels. It is a qualitative dictionary created ad hoc, used as an auxiliary tool to answer linguistic questions raised by an inductive didactic methodology that makes the Latin learning-teaching process available even to those students who lack basic syntactic knowledge. A structure of Hierarchical Faceted Categories that constitutes the lexicographic model provides various ways to access the lemmatised lexicon, facilitating intuitive navigation through the dictionary.

Keywords: Computational Lexicography; Learner's Dictionaries; Latin Lexicography; Bilingual Lexicography, Digital Dictionaries, Dictionary for special needs

1. Introduction

Learner's lexicography as currently conceived has its roots in the 1930s, when M. West, H.E. Palmer, and A.S. Hornby, teachers of English as a second language, took part in various lexicographic projects aimed at improving English learning (Jackson 2002). As a result of this work, in 1938 West published *The New Method English Dictionary*, which is regarded as the first monolingual English learner's dictionary (Heuberger 2016)¹, Plamer published *A Grammar of English Words*, aimed at the description of verbal models, and in 1942 Hornby – with Gatenby and Wakefield – published the *Idiomatic and Syntactic English Dictionary*, which years later was reprinted as *A Learner's Dictionary of Current English*, and which in 1952 was reprinted again as the *Oxford Advanced Learner's Dictionary of Current English* (Miller 2018). Since then, language learning dictionaries have been produced on an uninterrupted basis. However, this process has not been equal for all languages: Rothenhöfer (2013: 414), cited by Bugueño (2019: 68), and Onieva (2019: 149), states that the production of learner's dictionaries in languages like German and Spanish has not reached the levels of English lexicography. This is a striking situation, given that these are languages with a similar social prestige to English, with millions of speakers, and so their lexicographic treatment should be similar. The situation is even more striking in the case of learner's lexicography applied to a corpus (not dead) language, such as Latin. In fact, in the case of Spain, Latin learner's dictionaries, that is, those that in general are used in schools, are, as we shall see, nothing but lexicographic compendia that, both in their macrostructure and in their microstructure, follow the guidelines set by general Latin dictionaries (*A Latin Dictionary* by Ch. T. Lewis and Ch. Short, *Dictionnaire latin-français* by F Gaffiot, *Diccionario Latino-Español, Español-Latino* by A. Blánquez, and *Totius Latinitatis Lexicon* by E. Forcellini, the core of all these dictionaries), following the same method to list lemmas but restricting meanings, the description of complements, and examples. They are dictionaries intended to help Latin students, particularly in translation.

After observing that Latin learner's dictionaries in Spain over time followed a model inherited from the main general dictionaries, four years ago, we wondered if we could face the challenge of creating a Latin learner's dictionary for Spanish students - or students whose native language was Spanish - that improved learning effectiveness in an innovative way. The goal was to provide students with a lexicographic learning tool that, thanks to its form and contents, would facilitate the process of learning Latin and would motivate its study. The answer is *Diccionario Didáctico Digital de Latin*, which we present in this paper.

2. Background. The lexicography of Latin learning in Spain: from 1950 to 2020

The landscape of the lexicography of Latin learning in Spain currently comprises a small set of dictionary options for students – mainly the duo *Diccionario Ilustrado Latin: Latino-Español / Español-Latino* (DIL-VOX-VOX) published by Bibliograf S.A.² and *Diccionario Latin (DL-SM)* published by SM³, which are the top sellers in Spanish bookshops.

¹ According to Heuberger, citing Cowie (1999).

² <https://www.vox.es/>

DIL-VOX, at 715 pages, has perpetuated a lexicographic model that, since its third revised and extended 1950 version – which is the basis for all later editions, bringing together the dictionary and a brief grammatical summary of Latin – reached its 24th edition in 2011, and is one of the most popular dictionaries in schools. In 2001 the *DL-SM*, with 928 pages and a grammatical appendix, was published. Its renewed aesthetics (García Ferrer 2013) has attracted the attention of new generations of Latin students, coexisting in courses with *DIL-VOX*, a milestone not achieved by the other school dictionaries published from 1950 to 2020, which include *Diccionario de bolsillo latino-español, español-latino* by A. Vives, from 1954, *Diccionario manual latino-español y español-latino* by P. Múgica (7th edition), from 1958, *Diccionario español-latino* by Llauró y Márqués, from 1965, *Diccionario manual latino-español y español-latino* by A. Blánquez, from 1984, *Latín iter 2000* published by Ramón Sopena in 1989, and *Diccionario Cumbre latino-español, español-latino* published by Everest in 1999⁴. All of these are small lexicographic compendia of the larger works cited. Most likely, the reason for their lack of relevance and presence in courses is that the information they give is so extremely scarce that they are not sufficiently rich for text translation, the main skill that Spanish students need to acquire in their learning process, in accordance with the learning standards and goals established by Spanish educational institutions⁵. We would also like to highlight *Diccionario Latín-Español, Español-Latín* by J. Pimentel, which, even though it was published outside Spain, in Mexico (its 12th edition is from 2017), is also a leading seller in Spanish bookshops as an alternative to *DIL-VOX* and *DL-SM*, possibly because it provides a set of lexicographic items in line with the dictionaries mentioned. We will discuss this later, in section 4.1.

This is the production in analogical format. In digital format, the Latin learner's dictionaries that have been published are *DidacTerion*⁶, with 8,966 lemmas; *Latine Disce*⁷, with 1,950 lemmas; *Glosbe*⁸, a website that brings together bilingual dictionaries in various languages, one of which is Latin-Spanish, the number of whose lemmas is not given but which is continually updated, due to its nature as an ongoing collaborative project; and *Diccionario Didáctico Digital de Latín*⁹, a work which we will present and analyse in this paper.

As for metalexigraphic studies of the situation of the lexicography of Latin learning and the study of specific school dictionaries, the only reference that we have found is a paper by García Ferrer (2013), which is a comparative study of *DIL-VOX* and *DL-SM*. This section also includes the papers by Happ (1976) and Favarin (1979), which, despite being published outside Spain, proposed a Latin dictionary that would follow the descriptive valence model. Even though it is conceived more as a general work, we believe it should be included in this section as it is the first theoretical proposal along the lines of one of the theoretical frameworks for the dictionary to which this paper refers.

3. The Development of *Diccionario Didáctico Digital de Latín*

3.1. Theoretical foundations

A dictionary can be regarded, in general terms, as a “lexicographic artifact” whose goal is to meet the linguistic, cultural, social, intellectual, and professional needs (among others) of its potential users. In terms of its structure, following Wiegand (2010), it can be understood as a textual conglomerate that can be segmented into a number of components. In the case of language learner’s dictionaries, according to Heuberger (2018), each entry would have to include the following elements: definitions, examples and images, grammatical and use information, co-locations, pronunciation, data accessibility for intuitive and productive use of the dictionary, prologue and appendices, information on frequent words, and etymological information. However, depending of the language of the dictionary and the type of user targeted (beginner, intermediate, or advanced), some of these components may be optional: in the case of Latin, for example, the information on co-locations, pronunciation, etymology, and word frequency could be optional, depending on the dictionary’s approach. Thus, for a beginner, the absence of etymological information, co-location, and information on frequent words does not make the dictionary lose functionality.

On the basis of these concepts, as well as the analysis of Latin learner's dictionaries in the Spanish-speaking world and the principles of the Functional Theory of Lexicography, a new Latin learner's dictionary model was created. The Functional Theory of Lexicography, posited by Bergenholtz and Tarp (2002; 2003), argues that, when creating a dictionary, its users’ social and cultural environment should be first analysed to effectively meet their extra-lexicographic needs. Along these lines, and on the basis of our teaching experience, we designed a model that would facilitate understanding of how Latin works as much as possible. As an innovation, the cognitive function was established as the leading function of the dictionary (Grows 2011). Thus, it was assumed that a Latin learner's dictionary should not limit itself to providing information on the specification of the grammatical category, the description of the specifics of the lemma, complements, or contextual examples - all of which are very useful in translation, but not so much to teach Latin in a way that helps to understand how the language works – but rather should be an instrument whose use in different types of practice would intuitively and inductively provide knowledge of Latin on the basis of the students’ native language (in this case Spanish), considering users’ cognitive needs and academic profile at all times.

³ <https://www.grupo-sm.com/>

⁴ For a more specific study of the lexicography of Latin learning in Spain, see Márquez (under review).

⁵ On the contents and competences to be developed by students of Latin, see the Spanish Official State Gazette legislative provision: <https://www.boe.es/boe/dias/2015/01/03/pdfs/BOE-A-2015-37.pdf> [retrieved on 09/04/2020]

⁶ <https://www.didacterion.com/esddl.php> [retrieved on 09/04/2020]

⁷ <http://www.latinedisce.net/Dictionary.latin> [retrieved on 09/04/2020]

⁸ <https://es.glosbe.com/la/es> [retrieved on 09/04/2020]

⁹ <http://repositorios.fdi.ucm.es/DiccionarioDidacticoLatín> [retrieved on 09/04/2020]

3.2. Development methodology

To create and implement the new *Diccionario Didáctico Digital de Latín (DDDL)*, a method based on spiral prototype development was used [Boehm, 1986], with four sequential phases: (1) requirement analysis, (2) design and implementation, (3) test, and (4) revision and improvement. Three iterations of phases 2, 3, and 4 have been conducted so far. The results of each phase are given in the following subsections.

3.3. Specification of the *DDDL* objectives and requirements

To specify the requirements, an analysis of the type of user for whom the dictionary would be intended was first conducted, to later establish the basic functions that would guide the design of *DDDL*: students learning for the first time a language that is different from Spanish in that it is declined; students who lack basic linguistic knowledge, particularly in syntax; students who are not motivated to study Latin; students who, regardless of their social situation, have access to online materials. The information was obtained through personal interviews, the analysis of academic records¹⁰, and questionnaires¹¹. Once the general profiles had been examined, the *three basic goals* of the dictionary were established:

1. Facilitating and motivating the process of learning Latin.
2. Aiming the dictionary basically, although not exclusively, at beginning Latin students whose native language is Spanish, with little motivation, due to a large extent to the lack of basic theoretical knowledge of Spanish, which hinders learning other languages in general. Teachers who work with this kind of students are also regarded as potential users of the dictionary inasmuch as they can use it as a didactic resource.
3. Using online environments¹² that enable e-learning, b-learning, or m-learning, learning models with which the recent generations of students who are digital natives identify.

3.4. Prototype design and implementation

In the second phase of development of *DDDL*, the lexicographic, micro-, and macrostructure were configured. As an innovation, in the lexicographic model for *DDDL*, the verbal lemma, the basic core of Latin discourse, is the main axis around which the rest of units that constitute the lexicographic work revolve. The metaphor of a jigsaw puzzle is used to understand sentence formation and the dictionary as a repository of “lexical” pieces (figure 1). The verbal lemmas in the dictionary are the central pieces of the sentence and must be completed by joining the pieces that characterise basic sentence complementation. In fact, the image of jigsaw pieces is present in each of the dictionary lemmas as a visual element.



Figure 1. Metaphoric representation of the sentence as jigsaw puzzle pieces

The didactic strategy that underlies the metaphor of the jigsaw puzzle to understand sentence meaning is based on semantic knowledge of the formation of sentences in the student's native language to understand the formation of sentences in new languages. Using Dependency Grammar as a hypothesis, sentences are built or interpreted on the basis of the meaning of the main verbs, their valences, and the semantic values of their arguments. Sentences are presented as jigsaw puzzles in which the verb is the central piece (figure 1, grey piece), bringing together a number of mandatory pieces known as arguments to complete its meaning (figure 1, red and orange pentagons). The number of arguments taken by a verb depends on the *valence* of the verb. Once the student has located the verb and established the number of arguments that it takes, they can identify those arguments with the help of *semantic features*, which go from +/-animated and +/-human to +/-definite/non-definite and location. Figure 1 shows, for example, how the trivalent verb “dat” requires

¹⁰ The set of questions given by Tarp (2006) to establish the profile of dictionary users was considered.

¹¹ As regards motivation, for example, the items that measure the student's motivation builder to learn a foreign language given by Gardner (2004) were adapted.

¹² <http://repositorios.fdi.ucm.es/DiccionarioDidacticoLatin/>

a nominative argument that must be +animate +human (shown in red), a -animate + definite accusative (orange), and a +animate +human dative. This sentence comprehension strategy is the same as that used by students in their native language, so application is direct once they understand the metaphor.

LEMA:	
<i>do, S1 darle algo a alguien</i>	
<i>do, as, are, dedi, datum (1ª)</i>	
CATEGORÍA:	Verbo
LETRA:	D
<ul style="list-style-type: none"> • MICROESTRUCTURA VERBOS <ul style="list-style-type: none"> • ARGUMENTOS DEL VERBO 	
Numero Argumentos Significado 1: TRIVALENTE	
Significado 1: <i>darle algo a alguien</i>	
Primer argumento: Nominativo	
Caracterización Argumental 1: +animado +humano	
Segundo argumento: Acusativo	
Caracterización Argumental 1: -animado +definido	
Caracterización Argumental 2: -animado -definido	
Tercer argumento: Dativo	
Caracterización Argumental 1: +animado +humano	
Ejemplo:	
Vir consillum filis dat.	

Figure 2. Features and values of the verbal lemma “do” (“to give”)

Thus, the lexicographic design of the dictionary was carried out considering the following theoretical principles that underlie the didactic strategy of the jigsaw puzzle:

- Dependency Grammar (Tesnière 1959; Ágel, V. & Fischer, K. 2010): following Valence Theory, verbal lexicographic articles describe the quantitative and qualitative valence of those units. This provides a classification and search mechanisms for verbs on the basis of their argument complements, that is, the number of mandatory complements required by a verb for its semantic development to be complete. Thus, a distinction between monovalent, bivalent, and trivalent predicates is made (figure 2) - aivalent cases are not included, as there are no argument complements. There are cases, such as *s.v. peto*, in which the same verb has two alternative valences (a trivalent and a bivalent one): dictionary users can see how a change in the number of arguments entails a change in meaning. The same thing happens when a verb has two quantitatively identical but qualitatively different valences; *s.v. placeo* is a bivalent verb that has two different meanings, depending on the morphology of its arguments: M1 To delight someone (nominative + dative) – M2 To decide something (nominative + infinitive).
- Ontologies: taking as a theoretical basis the distinction between first-, second-, and third-order entities established by Lyons (1977), we gave an ontological definition of the verbal arguments and nouns in the dictionary depending on their lexical characterisation: +animate +human (human beings), +animate -human (animals and living plants), -animate +definite (objects, concrete entities), -animate -definite (concepts, feelings, abstract entities) and places. Ontological differences in complementation help to distinguish meaning. Thus, *s.v. occurro* gives two different meanings for the same number of arguments (bivalent verb), with the same morphology (nominative + dative): “meeting someone” with a first argument in the nominative (+animate +human) and a second argument in the dative (+animate +human) as opposed to “facing something”, with a first argument in the nominative (+animate + human) and a second argument in the dative (-animate -definite).
- Definition of semantic functions: the dictionary gives the option - not yet public - of showing users the semantic function of verbal arguments on the basis of the semantic roles defined by Fillmore (1968:1971). *DDDL* is a lexicographic tool that is part of an inductive methodology developed for early stages of Latin learning. In this methodology, verbal argumentation is explained by means of argument valence, as well as the morphology, ontology, and semantic roles of the elements. These roles are not labelled, but explained on the basis of Fillmore’s definition of cases. However, we thought that it would be important for the dictionary to provide the label of each argument role, so that advanced users can access that information at a later stage in their learning.

Lexical units - or the jigsaw pieces - are arranged in the dictionary, grouped into lexical category, meaning, semantic feature, or valence. To do so, we followed the Hierarchical Faceted Categories model given by Hearst et al. (2006): “[...] build a set of category hierarchies each of which corresponds to a different facet (dimension or feature type) relevant to the collection to be navigated.”¹³ (Hearst et al. 2006: 86). In the case of *DDDL*, the facets are the part of speech categories it contains: verb, noun, adjective, pronoun, adverb, preposition, conjunction, interjection, and particle. Each category is structured in a hierarchy according to the semantic and morphological features that characterise the lexical units in each category. Thus, in the case of the verb category, which is the most complex one, the first level is the feature valence of the first meaning of the verb with monovalent, bivalent, or trivalent values (figure 3). The second level is structured in turn

¹³ A more detailed description of inductive and dynamic creation of navigation hierarchies can be found at (Fernández-Valmayor, et al., 2013)

into several subhierarchies: one for meaning (Spanish translation), another one for the first argument characterization (with all possible cases), another one for the second or third argument characterization (in the case of bivalent or trivalent verbs), and finally a subhierarchy for each predicative framework characterization for the following meanings of the verb, when it is polysemous.



Figure 3. Hierarchy of features and values for the verb category

This cognitive organisation is used to create the dictionary navigation scheme. In this way, students can not only conduct conceptual searches, but also inductively learn about semantic and morphological features and their potential values while exploring the dictionary. This learning is, in our didactic hypothesis, crucial to understanding how Latin works. In addition to this navigation mechanism, students can search by using the traditional text search systems, entering a word or part of a word in Latin or Spanish in a text box, or by means of an advanced search form.

As regards implementation, the dictionary currently comprises 720 lemmas of public use. Collaborative work continues to gradually increase the number of dictionary entries¹⁴. To select verbal lemmas, the criterion followed was the frequency of appearance in the *LatinISE historical corpus v2.2*, using Sketch Engine¹⁵ to access the data. Terms that appeared between 200 and 5,000 times in the corpus - which comprises the pre-Classical, Classical, and post-Classical periods of Latin - were selected. These limits discounted working with verbs that would all too often also display a high degree of polysemy, which would hinder meaning and complementation selection (with the exception of such verbs as *habeo*, *do*, *mitto*, *sum*, *accipio*, *peto*, *pono*, and *quaero*, which are verbs with the basic semantics to create sentences in the activities proposed to work with the dictionary). The idea of working with verbs of scarce relevance in the corpus was also rejected, as they tend to have such restricted semantics that they would not serve to enrich the dictionary. Verbs that would cover all types of action, process, status, and position were selected¹⁶.

In the second stage, the *Oxford Latin Dictionary* and *A Latin Dictionary* were used to compare the definitions and complements of the selected lemmas¹⁷. Julius Caesar's *De Bello Gallico* was used as a secondary source to find examples in the specific work of an author that is usually taken as a reference in the EvAU examination (the Spanish Assessment for Access to University). This latter decision was based on the argument that students should gradually become familiar with a lexicon that they might use again in later years of study, should they choose the Latin option in EvAU.

As for nouns, selection was much simpler, finding lexical units that represented persons, animals, plants, tangible entities, abstract entities, and places on the basis of verbal complement ontologies. The sources used were again *De Bello Gallico* and *Diccionario Latino-Español, Español-Latino* by A. Blázquez (1997), specifically the Spanish-Latin dictionary part. Adjectives were selected considering the nature of the lemmatised nouns, so that they could properly perform their specifying or explanatory roles. When selecting the rest of lexical units (adverbs, pronouns, prepositions, conjunctions, interjections, and particles) Rubio & González Rolan's grammar (1990) was used.

Finally, as regards the examples that illustrate meanings and complements, they were created ad hoc by three Latin teachers, members of the Project for Educational Innovation, of which *DDDL*¹⁸ is part, thus passing three filters.

3.5. Prototype test, revision, and improvement

In phase 3, the test stage, the educational effectiveness of prototypes was assessed using two mechanisms:

¹⁴ 80 new verbal lemmas will be opened for public use in September.

¹⁵ <https://www.sketchengine.eu/>

¹⁶ This classification corresponds to the State of Affairs described by Dik (1997), which is what happens in a real or imaginary world, represented by a verbal predicate and its arguments.

¹⁷ At this point, we would like to emphasise that these dictionaries were only used as guides, given that, as we have argued, we did not intend to create a heritage dictionary: we do not follow the usual synonymic translation procedure but explain the verbal expression by referring to the actants involved in the action, process, state, or verbal position described.

¹⁸ Educational Innovation Project PIE 245: 2019_20 funded by the Universidad Complutense de Madrid. The dictionary was completed within the framework of four sequential educational innovation projects since school year 2016-17. More information at: <https://www.ucm.es/afpc/proyecto-de-innovacion-docente-y-mejora-de-la-calidad>

- (i) Didactic quality, through the assessment tool of Spanish standard UNE 71362 “Quality of digital educational materials” (UNE71362:2020). The assessment tool UNE 71362 comprises 15 criteria with 87 items to assess three aspects: the didactic, technological, and accessibility effectiveness of digital educational materials¹⁹. The tool was applied to assess the first *DDDL* prototype in July 2017, by means of a peer review in which 3 Latin teachers and 2 students took part. In this assessment, specifically, the teacher's and student's profile for the tool were used (CTN 71/SC 36, 2017). The results made it possible to correct the prototype before its experimental application.
- (ii) Experimental assessment of didactic effectiveness. This assessment is ongoing. The research question that is being tackled is whether *DDDL* really helps or facilitates the comprehension or generation of simple sentences in Latin. To this end, a longitudinal quasi-experimental study is being conducted of measures repeated during the three academic years 2017-18, 2018-19, and 2019-20. This kind of design has been selected given the impossibility of having randomly assigned groups of students²⁰. So far, an initial study case (Márquez & Chávez, 2016) and four experiments²¹ have been conducted. The results of the first of the experiments indicate that the new didactic methodology improves motivation and, more specifically, the “positive attitude towards learning Latin among students” (Márquez & Fernández-Pampillón, 2019). Also, possibly, as a consequence of this positive attitude, an improvement is observed in “the stimulus of parents towards the learning of their children”. The rest of the results are currently being analysed, though this activity has been interrupted by the current health situation as the experimental materials are not available. We expect to publish them shortly.

The results of each experiment served to revise and improve *DDDL* in phase 4, reaching the current configuration, which is presented in section four below.

4. *Diccionario Didáctico Digital de Latín*

DDDL is a bilingual lexicographic work to learn Latin hosted in a digital repository at the Universidad Complutense de Madrid, created using the *Oda* software. Access to the dictionary, which is online and free, is regulated by a *Creative Commons Attribution-ShareAlike 4.0*. According to the lexicographical model presented in the previous section, the dictionary navigation system allows varied access to the lexicographic data: in addition to simple queries (by lexical unit, based on form, meaning, conjugation, gender, part of the chain of characters that constitute the lexical chain) and complex queries (a way of accessing the data where it is possible to specify, for example, the number of mandatory arguments, their morphology and ontology, and the meaning), as an innovation, lemmas can be conceptually accessed by navigating through the dictionary by grammatical category and semantic-morphological features. Each of the nine grammatical categories has its own structure, generating the entries described below:

- Verbs: **lemma** (the first person singular of the present indicative is used); **meaning**; **classic form** (the traditional nomenclature is used: first person singular of the present indicative, present infinitive, first singular of the past perfect and the supine)²²; **verb conjugation** (specification of the type of verb conjugation to which the verb belongs); **category** (grammatical category: verb); **letter** (initial letter of the lexical unit)²³; **verb valence** (description of the type of verb on the basis of the number of arguments it takes: monovalent, bivalent, trivalent); **meaning** (relative to the verb valence); **argument position** specifying its **morphology** and its **ontology**; **example**.
If a verb has two valences, each of them is described by means of the features described above.
- Nouns: **lemma** (nominative singular); **meaning**; **classic form** (nominative and genitive singular); **gender** (masculine, feminine or neuter, stated as an abbreviated form); **category** (noun); **letter**; **logical categorisation** (ontology); **meaning**.
- Adjectives: **lemma** (nominative singular of the different genders); **category** (adjective); **letter** and **meaning**.
- Pronouns: **lemma**; **category** (pronoun); **letter** and **meaning**.
- Adverbs: **lemma**; **category** (adverb); **letter** and **meaning**.
- Preposition: **lemma**; **category** (preposition); **letter** and **meaning**
- Conjunction: **lemma**; **category** (conjunction); **letter** and **meaning**
- Interjection: **lemma**; **category** (interjection); **letter** and **meaning**
- Particles: **lemma**; **category** (particle); **letter** and **meaning**

¹⁹ An English version of the standard will soon be published at <https://www.une.org/>. A summary can be found in (Fernández-Pampillón, 2017)

²⁰ This limitation is in any case frequent in experiments in education contexts (Schanzenbach 2012: 221).

²¹ Two more experiments, making a total of seven, had been scheduled, but they were cancelled due to the shutdown of educational centres in the second quarter due to the Covid-19 pandemic. The publication of the results of the last two experiments has had to be postponed for the same reason.

²² To distinguish the meaning from the lemma, a different font is used, and the different meanings are numbered (S1, S2). The meaning is not reduced to a mere semantic equivalence in the target language, as is standard in bilingual dictionaries, but the arguments involved in the verbal expression are specified. As for the classic form, the font is the same as that of the lemma so that their connection is clear. The same procedure is followed for nouns.

²³ This information is included in all the lexical units that constitute the dictionary and makes it possible to edit the dictionary on the basis of the alphabetical order of the units it comprises.

Regarding the hyperstructure of the dictionary, in addition to the macro- and microstructure described, *DDDL* has an introduction and appendices explaining how the dictionary works by means of videos (Guidelines for Use), explaining the abbreviations used in the dictionary, giving an introduction to a Latin course whose activities are connected to the use of the dictionary (Introduction to Latin Course), providing additional materials for study of the first Latin declinations, verbs, and prepositions (Lessons), providing links to download the main scientific works published about the dictionary (Related Publications), and giving the list of participating and collaborating teachers and researchers (Working Team).

4.1. Comparing the *Diccionario Didáctico Digital de Latín* microstructure to other learner's dictionaries

The microstructure of the lexical entries given in *DDDL* differs both in the form and in the basis of the treatment given to lexicographic items from other Latin learner's dictionaries, in particular in the case of verbal and nominal units. Specifically, in the case of verbal lemmas, the first innovation can be seen in the way in which the items are specified: the first person singular of the present indicative is used, followed by the meanings associated with the lemma and the conventional form given in the rest of Latin dictionaries (first and second person present, present infinitive, first person singular of the past perfect and the supine). The justification for this decision on the formalisation of verbal lemmas is a didactic argument: bookending the meanings of the lemma with the present form - as it is the first of the tenses usually taught²⁴- and the rest of the verbal forms given according to convention, so as to comply with the standard and to allow users to become familiar with the form of the entry for verbal lemmas in other dictionaries. Regarding the rest of the information given in the lexicographic articles, we will now explain, by means of a comparative study, the differences between the treatment of entries in *DDDL* and other Latin learner's dictionaries, like *DIL-VOX* and *DL-SM*. To do so, we have selected the lemma *paveo*. This lemma has been selected because of the complexity of its lexicographical treatment, given that it is a sentiment verb - specifically, fear - a type of verb that usually poses difficulties when describing its complements with respect to its meaning.

Diccionario Ilustrado Latín

paveo, pāvi — 2 INTR.: to be afraid (*pavens admiratione*, disconcerted by surprise) || to take fright ¶ TR. to fear (*nec pavent numerare plagas*, and they do not fear counting their wounds).

<p>LEMA: <i>paveo</i>, S1 <i>alguien se siente aterrado/atemorizado</i>, S2 <i>alguien tiene miedo de alguien o de algo</i></p> <p><i>paveo</i>, es, ere, ere, pavi, - (2ª)</p> <p>CATEGORÍA: Verbo</p> <p>LETRA: p</p> <p>• MICROESTRUCTURA VERBOS</p> <p>TIPO VERBO (según número de argumentos): <i>MONOVALENTE, BIVALENTE</i></p> <p>• ARGUMENTOS DEL VERBO</p> <p>Numero Argumentos Significado 1: <i>MONOVALENTE</i></p> <p>Significado 1: <i>alguien se siente aterrado/atemorizado</i></p> <p>Primer argumento : <i>Nominativo</i></p> <p>Caracterización Argumental 1: <i>+animado +humano</i></p> <p>Caracterización Argumental 2: <i>+animado -humano</i></p> <p>Ejemplo: Caesar pavet</p> <p>Numero Argumentos Significado 2 (Si Existe): <i>BIVALENTE</i></p> <p>Significado 2: <i>alguien tiene miedo de alguien o de algo</i></p> <p>Primer argumento : <i>Nominativo</i></p> <p>Caracterización Argumental 1: <i>+animado +humano</i></p> <p>Caracterización Argumental 2: <i>+animado -humano</i></p> <p>Segundo argumento : <i>Acusativo</i></p> <p>Caracterización Argumental 1: <i>+animado +humano</i></p> <p>Caracterización Argumental 2: <i>+animado -humano</i></p> <p>Caracterización Argumental 3: <i>-animado -definido</i></p> <p>Ejemplo: Agnus lupos pavet</p>	<p><i>Diccionario Latín</i></p> <p>paveo, -es, -ēre, pavi, - (2) v.tr./intr. 1 to be overcome, to be distraught, to be anguished (<i>tremet ille pavetque</i>- he trembles with fear and anguish) 2 to fear, to be afraid of (<i>pavet agna lupos</i> - the lamb fears the wolves).</p>
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²⁴ Mariner (1986) argued that perhaps the past form should be taught before the perfect, as it is a tense that displays fewer formal alterations.

Figure 4. The lexicographic item *paveo* in *DDDL*

This is a verb of dubious etymology which has no supine. Both dictionaries specify the conjugation and the transitive and intransitive forms of the verb. However, while *DIL-VOX* clearly distinguishes between transitive and intransitive use, *DL-SM* does not: from the examples, it can be inferred that **1** is the intransitive, while **2** is the transitive, at least in Spanish. However, treating the meanings of “to fear” and “to be afraid of” as transitive requires a previous explanation that justifies the transitivity of the second meaning. *DIL-VOX Latin* is more consistent in the structure of meanings and complements, but the examples used - one of the strong points of learner's dictionaries - can be misleading: *pavens admiratione* is translated as “disconcerted by surprise”, where the sentiment described in the meaning “to be afraid” that precedes the example is not found. As for the translation of the example of the meaning “to fear”, *nec pavent numerare plagas*, “and they are not frightened about counting their wounds”, is again a variation with respect to the meaning given, turning the second Latin argument into the first argument in its Spanish translation. Perhaps a translation like “and they are not afraid of counting their wounds” would have been more consistent.

DDDL does not use labels that mark the transitivity or intransitivity of a verbal predicate, given that, as stated before, they can be misleading if they are not consistent with the translation. As for meanings, given that the goal of the dictionary is not to provide all the semantic range of the verb in question, but to provide patterns of use that users can compare to those of other lexical units with similar semantic behaviour, on the basis of the qualitative nature of the dictionary, two meanings have been selected that we understand offer enough information about the behaviour of Latin. The first one refers to the monovalent behaviour of the predicate: a verb with a single argument described as an +animate entity, a logical argument, given that sentiment is proper to animate beings. The morphology of that single argument is also described, nominative in this case. The second meaning appears when the behaviour of the verb is bivalent, taking two arguments: one first argument, in the nominative, +animate (the entity that experiences the sentiment) and a second argument, in the accusative, characterised as +animate or -animate -definite (the sentiment of fear is generated by a human, an animal, or concepts such as war, winter, loneliness, etc.) Each meaning and valence description is followed by an example. This structure is intended to ensure that users understand that both *paveo* and other similar sentiment verbs (*metuo* or *timeo*) have similar behaviour. That is, being verbs that express fear, a single +animate argument in the nominative (the source experiencing fear with no cause) is expected, or else a double argument in the nominative and in the accusative, the latter expressing the entity that causes the sentiment of fear.

We believe that dictionary queries can consolidate knowledge in the user that can be expanded at later stages with other metaphorical meanings or co-locations that extend the user's mastery of the behaviour of lexical units in Latin.

5. Conclusions and future work

Both the analysis conducted to establish the type of potential users of the dictionary and their needs and the theoretical linguistic frameworks used to create *DDDL* are innovative in the lexicography for the learning of Latin, at least in Spanish. Other significant contributions of the new *DDDL* dictionary are:

- The proposal of a new way to understand and learn Latin from a conceptual and constructivist point of view based on the theoretical linguistic frameworks of valence theory, Lyons' ontologies, and Fillmore's semantic frame theory.
- The jigsaw puzzle metaphor used as a reasoning and visual element in *DDDL*. In this metaphor, verbal lemmas are the core piece of the sentence meaning construction process and they are represented by triangular shapes with one to three protrusions, depending on whether they are monovalent, bivalent, or trivalent. Nouns, as complementary semantic pieces, have the shape of a pentagon that fits with the protrusion in the verb triangle. The colour of the pentagon also refers to a specific ontology (red, for example, represents an +animate +human unit), which fits the lexical characteristics required by the verbal complement.
- The mechanism of translation of the verbal lemmas which is not done by synonymic equivalent in the target language, but by a semantic-argumental description, based on the users' lexical knowledge of their native language (in this case, Spanish): e.g. the translation of the Latin word “do” is not “to give”, but “someone gives something to someone”.
- The description of the verbal complements, which starts at the semantic level and reaches the morphological level with no syntactic labels when establishing the complementation relationship.
- Its conception as an educational resource that can be easily integrated in e-learning, b-learning, and m-learning training and self-training proposals.

According to the results obtained so far in the experiments, these contributions seem to help learners to understand the new language on the basis of their knowledge of their native language. The learner realizes that on the semantic level, Latin works like his or her mother tongue, on the morphological level it differs in the use of marks to indicate cases and on the syntactic level the learner realizes that the order of the constituents is different, but that does not hinder him or her from being able to understand, and even with a little observation, construct sentences that are not always syntactically correct, but correct and comprehensible from the morpho-syntactic point of view. We have found that this learning path empowers the student and prepares him/her for deeper language learning.

The next step in our work will be to not only continue to test and improve didactic effectiveness of the DDDL, completing the longitudinal experiments that are being conducted, but also to consider how to complete the dictionary so that it can also be useful for learners at higher levels. Finally, we are interested in determining whether the hypotheses on which this dictionary is based apply to other languages.

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