10.15446/fyf.v35n2.91129
Artículos

NEW INSIGHTS AND METHODS OF VOCABULARY ACQUISITION IN LATIN CLASSES*

NUEVAS PERSPECTIVAS Y MÉTODOS DE ADQUISICIÓN DE VOCABULARIO EN LAS CLASES DE LATÍN

Andrea Beyer[1]
Konstantin Schulz[2]

Cómo citar este artículo:
Beyer, A., & Schulz, K. (2022). New Insights and methods of vocabulary acquisition in Latin classes. *Forma y Función*, *35*(2). https://doi.org/10.15446/fyf.v35n2.91129

Recibido: 2020-10-23, aceptado: 2022-01-20

* This paper extends a presentation at the Congreso internacional sobre la enseñanza y el aprendizaje de lenguas clásicas (2.9.2019, Bogotá). The underlying research project CALLIDUS (Computer-Aided Language Learning: Vocabulary Acquisition in Latin using Corpus-based Methods) is funded by the German Research Foundation (project number 316618374).

1 ORCID https://orcid.org/0000-0002-8468-6411 Humboldt-Universität zu Berlin, Berlín, Alemania. beyeranz@hu-berlin.de

2 ORCID https://orcid.org/0000-0002-3261-9735 Deutsches Forschungszentrum für Künstliche Intelligenz, Berlín, Alemania. Konstantin.Schulz@dfki.de

Abstract

Learning a historical language is different from learning a modern language in view of the emphasis on the work on texts instead of everyday communication. Therefore, not only the expectations and motivation differ, but also the teaching methodology. Whereas learners of modern languages focus on language production, learners of Latin read or translate their texts. Because of the overall low frequency of occurrence of a Latin word or a phrase in this kind of learning environment, most students are often unfamiliar with a given word and therefore finally unable to translate the texts. To tackle this underlying problem of Latin classes, an interdisciplinary research project conducted different studies using a data-driven learning (DDL) approach. So far, the findings are very multifaceted and sometimes even surprising: the majority of students fail to lemmatize words correctly even though they have learned Latin for four years or more.

Keywords: *Latin; vocabulary acquisition; data-driven learning (DDL); corpus-based exercises; historical language.*

Resumen

El aprendizaje de una lengua histórica es diferente al de una lengua moderna por el énfasis que se pone en el trabajo sobre los textos en lugar de la comunicación cotidiana. Por tanto, no solo difieren las expectativas y la motivación, sino también la metodología de enseñanza. Mientras que los estudiantes de lenguas modernas se centran en la producción lingüística, los estudiantes de latín leen o traducen sus textos. Debido a la escasa frecuencia de aparición de una palabra o frase en latín en este tipo de entorno de aprendizaje, la mayoría de los estudiantes no suelen estar familiarizados con palabras determinadas y, por tanto, son incapaces de traducir los textos. Para abordar este problema subyacente de las clases de latín, un proyecto de investigación interdisciplinar realizó diferentes estudios utilizando un enfoque de aprendizaje basado en datos. Hasta ahora, los resultados son muy variados y a veces incluso sorprendentes: la mayoría de los estudiantes no logra lematizar correctamente las palabras a pesar de haber aprendido latín durante cuatro años o más.

Palabras clave: *latín; adquisición de vocabulario; aprendizaje basado en datos; ejercicios basados en corpus; lengua histórica.*

1. Introduction

In contrast to other countries, it is common to learn Latin as a foreign language in German high schools. Following English and French, the historical language Latin is still the third most important foreign language with about 600.000 students (Statistisches Bundesamt, 2020), especially in grades 7 to 10. While the number of students have decreased rapidly for the last ten years, the future of Latin in secondary schools is discussed as fiercely (Behrendt & Korn, 2016; Kipf & Kuhlmann, 2015) as are the conclusions drawn from this (Beyer, Kipf, Liebsch, & Zimmermann, 2019; Hensel, 2017; Korn & Kuhlmann, 2017). In fact, there are two main questions unresolved:

- First, what does a student gain by learning Latin in high school?

- Second, why do the students have so many problems in achieving a specific language level, especially in terms of vocabulary, that enables them to translate text passages from Latin literature?

To the first question, some answers are offered –knowledge about language(s), literature, ancient history and European culture, transferable skills (e.g. meta-learning) and strategies of text processing– that all are parts of the humanistic view on education, i.e. Humboldt's concept of *Bildung*, and lacking an economically motivated purpose. Obviously, students can achieve these results only if they acquire a sufficient level of language competence and performance in Latin (and German). Therefore, finding answers to the second question will be the main focus of this paper.

Upon closer examination of the (German) literature referring to the Latin language proficiency of students, one topic is recurring: the difficulties that students have when learning Latin vocabulary (Hermes, 1988; Kuhlmann & Horstmann, 2018; Steinthal, 1971; Stirnemann, 2009; Utz, 2000). After a subsequent analysis of the circumstances of Latin as a subject in German high schools, one might conclude that there are probably three major reasons for this ongoing problem of vocabulary acquisition in Latin classes:

- A domain-specific reason: Latin as a historical language focuses on translation whereas reading and, more importantly, oral communication do not matter in German secondary schools (Deutsche Kultusministerkonferenz, 2005). Thus, both teachers and students are not used to Latin language production though it is necessary for achieving a high level of language proficiency (cf. Output Hypothesis, Swain [1995]). Additionally, regarding the teaching objective «translation», they all tend to think cross-lingually

(Latin-German) rather than intra-lingually (Latin-Latin) at the word level although a good translator needs intra-lingual understanding at the word, sentence, and text level (cf. different translation theories, Siever [2015]).

- A scientific reason: There is a lack of research, empirical studies, and data on learning Latin, especially in the German-speaking community (Beyer, 2019, p. 1). Furthermore, findings from linguistics and its subordinate fields such as computational linguistics and psycholinguistics are hardly taken into account in the curriculum of Latin (or Ancient Greek) philology at German universities. Hence, it is not surprising that insights from language acquisition research, the theory of the mental lexicon or a corpus-based approach of vocabulary learning are known just to a small minority of professionals. Consequently, learning materials offered by publishing houses include these insights just as little so that vocabulary acquisition does not receive new research-based input.

- A methodical reason: Due to the aforementioned reasons, there is a lack of a broad understanding of vocabulary or vocabulary competence and the importance of explicit vocabulary learning in Latin pedagogy. Thus, vocabulary acquisition does not follow a systematic approach and still receives almost no attention in classes (Kuhlmann, 2016, p. 50), because it is perceived as tedious and time-consuming. Overall, vocabulary learning is restricted to homework, reduced to learning translational equivalents and finally tested in a completely decontextualised manner, despite suggestions to the contrary (Kuhlmann, 2016, pp. 50-55).

To tackle these difficulties at least partly, it seems appropriate to work in an interdisciplinary research project of corpus linguistics, Latin pedagogy, and computer science, the CALLIDUS project. Within this project, the main research question is whether the data-driven (language) learning (DDL) approach (Braun, 2007; Talai & Fotovatnia, 2012) proposed in second language acquisition (SLA) research can be applied to a historical language like Latin. Because of the missing domain-specific theories and data, the research began by designing a model of Latin vocabulary acquisition according to the theory of the lexical representation in the mental lexicon (form level, lemma level, conceptual level [Levelt, Roelofs, & Meyer, 1999, p. 4]). To gain insight into what students know about Latin vocabulary and their strategies of inferring the meaning of words, two intervention studies with intermediate learners were conducted (see ⁋0 and ⁋0). On this basis, the promising methodology of DDL was further adapted to Latin classes by carrying out a study on a new concept of introducing and understanding vocabulary

with beginners (see [0]). In addition, the results of the first studies were combined with the DDL approach to develop a mobile-friendly software for creating corpus-based vocabulary exercises (Boulton, 2017; Gilquin & Granger, 2010). The *Machina Callida* was the basis of a fourth study on the outcome of a context-based vocabulary approach compared to learning simple word equivalents (see [0]).

2. Methodology

In the four intervention studies conducted in three secondary schools in Berlin so far, 11 groups with a total of 283 students participated. To preserve the authentic educational context, the samples were not randomised (group = class) and exhibit a self-selection bias, i.e. they were influenced by the choice of the teachers willing to collaborate. For reasons of data privacy, the students got an individual ID, but were not asked for their gender, other known languages, reading habits or anything else. In general, all studies had a DDL approach and a wide variety of vocabulary tasks (e.g. word formation or word meaning) in common. However, they differed in the amount of context given, the length of the intervention and the Latin text corpus, depending on the language proficiency level and age of the participants.

2.1. Study with Intermediate Learners Based on a Text by Cicero

The first study was aimed at collecting data about students' knowledge of Latin vocabulary and about their skills while dealing with Latin words. It was conducted in summer 2018 with two groups (Table 1) that were taught by the same teacher. Before starting the intervention, she perceived the students of the test group as significantly weaker, especially referring to their overall cognitive skills.

Table 1. Participants in the study (Cicero)

Group	Group size	Number of participants	Grade	Age	Learning Latin
Test group	30	27	9th	13-15	5th year
Control group	28	19	9th	13-15	5th year

After the pre-test (45 min.) both groups worked for 12 lessons (about 4 weeks) with the same Cicero text prepared for intermediate learners (extracts of the letter *Ad Quintum fratrem* I, 1), but only the test group received an intervention that focuses on different vocabulary tasks: basic form, polysemy, word formation rules, fixed word pairs, collo-

cations, and strategies for the cross-linking of words. The 172 selected lemmata of the intervention and the tests pertain to a core vocabulary of the 500 most frequent words presented in all current textbooks (Utz, 2008). The intervention was concluded by a post-test (45 min.) identical to the pre-test. Both tests are restricted to the above-mentioned lemmata and contain tasks in five categories (basic morphological knowledge, word cross-linking strategies, strategies to decode word meaning, phrases, and application of vocabulary knowledge) including language production tasks, e.g. creating Latin phrases by using words given in pools. Additionally, they gave the students the opportunity to rate the difficulty of both the task type and the task assignment.

2.2. Study with Intermediate Learners Based on Texts by Ovid

The second study focused on context-based vocabulary tasks and was carried out in winter 2018/19. Different teachers taught the selected groups (Table 2) of which the test group appeared to be a group of learners who had a lower learning outcome than the control group.

Table 2. Participants in the study (Ovid)

Group	Group size	Number of participants	Grade	Age	Learning Latin
Test group	30	21	10th	14-16	6th year
Control group	30	27	10th	14-16	6th year

After the pre-test (45 min.) both groups worked for about 8 weeks on the same Ovid text prepared for intermediate learners (the metamorphosis *Pyramus et Thisbe*, IV, vv. 55-166), but only the test group received the text with an intervention consisting of a theoretical introduction to vocabulary acquisition and various vocabulary tasks. These tasks offer context-based learning activities that refer alternately to metacognitive strategies or to the form, lemma, or conceptual level of the lexical representation in the mental lexicon. Like the first study, this one relies on a small number of selected lemmata (165) matching the Ovid texts and the previously mentioned core vocabulary. Finally, the intervention ended with a post-test (45 min.) identical to the pre-test in structure, but not in content, because the context-based questions called for choosing another metamorphosis. Both the tasks of the intervention and of the tests are restricted to the afore-said lemmata. On the one hand, the tasks explicitly address aspects of vocabulary acquisition that have so far mostly been an implicit part of Latin classes (e.g. to give the basic form of an inflected word), and on the other hand, they explicitly

demand metacognitive action from the students (e.g. to explain how the basic form can be derived). Additionally, each test also covers an unabridged metamorphosis including ten test items and providing an opportunity for the students to rate the difficulty of both tasks and task assignments. To be able to master this amount of text and test items in one lesson (45 min.), both metamorphoses were supplemented with subheadings, introductory and transitional German texts and were mainly offered in a bilingual or paraphrased form. At the end of the tests, the understanding of the context is checked by a bonus task. In this task, the students have to answer the question about the nature and end of the respective metamorphosis while providing text references. The aim of the entire test design is to give the learners as much context as possible when completing the vocabulary tasks.

2.3. Study with Beginners Based on Textbook Material Relying on a DDL Concept

The third study was concerned with implementing a DDL concept for vocabulary acquisition into Latin classes and was conducted in the school year 2018/19 (Table 3). The same teacher taught both test groups while different teachers instructed the control groups.

Table 3. Participants in the study (textbook)

Group	Group size	Number of participants	Grade	Age	Learning Latin
Test group 1	28	27	5th	10-11	1st year
Control group 1	30	25	5th	10-11	1st year
Test group 2	29	27	5th	10-11	1st year
Control group 2	29	24	5th	10-11	1st year

Because the students did not know any Latin at the start of the study, it was necessary to design a German-based test that evaluates skills needed by the students for translating (i.e. decoding a text) and learning Latin vocabulary (e.g. technical terms, word formation rules). Thus, the identical pre-test and post-test contain a text on the Punic wars (readability: 7th grade), a reading comprehension test (8 tasks, 10 points) and a test of vocabulary knowledge (5 tasks, 20 points). By relying additionally on a Design-based Research approach (Bakker & van Eerde, 2015) for constructing the intervention it was always possible to react to the learning requirements and keep the design agile. In general, the intervention was designed as a complement to the used

textbook, but it changed the practice and order of teaching absolutely, as it was now necessary to start each unit with the context-based introduction of new words. After transferring the theoretical concepts of DDL and vocabulary competence into learning materials, the intervention consists of the following parts for each unit:

- Context-based introduction of vocabulary where the meaning of a new Latin word has to be inferred.
- Worksheets on vocabulary knowledge and strategies including tasks.
- Exercises focusing on Roman culture and practising vocabulary in a broad sense.
- Vocabulary test (DDL test) with the same task formats and order for each unit.

When three units are done, a traditional vocabulary test (list of word pairs) follows. In this test, the vocabulary of the last three units is divided into four tests, clustered by word, class, and distributed randomly in a test group. In this way, it was possible to collect a vast amount of data on the learning progress of each student (pseudonymously).

2.4. Study with Intermediate Learners Based on the Vocabulary Unit

The fourth study aims at investigating the impact of context-dependent, corpus-based vocabulary learning on students' vocabulary competence. It is carried out in the vocabulary unit of the project software. The unit is not confined to selected students or students at all, but to any participants who know Latin. In autumn 2019, more than 800 exercise results by 13 participants were evaluated –since all tests were performed almost simultaneously, it is likely to be a group of students. To provide the same conditions for all participants, the study has to work independently of the preceding learning environment. Therefore, the usual study setting is enhanced with a text basis simulating a typical Latin class with its text work (pre-test – Latin text: introduction and comprehension tasks – intervention: exercise – post-test) and takes just 40 min. (about one lesson). Within this study, participants should learn vocabulary that is part of the processed Latin text and examined in the post-test (= pre-test). Both tests contain five exercise types on different aspects of vocabulary knowledge, e.g. word formation or inflection. Besides, the actual intervention consists either of cloze exercises built from the processed text (corpus-based learning, i.e. DDL) or of a word list with free text fields including all the words of the processed text (learning of word pair associations) given randomly to the users. This way, it is possible to measure different learning outcomes in the post-test depending on the assigned type of exercise.

2.5. Hypotheses

The main hypotheses underlying the studies are based on our evaluation of the research literature and can be summarized as follows:

- DDL makes Latin vocabulary learning more appealing for the students and is a good preparation for understanding Latin texts.
- A student's evaluation of the task statements and difficulty should be included in tests and exams. It helps to evaluate scientific studies and to predict the student's performance.
- Consistent focus of training and testing: Vocabulary-oriented learning phases should be followed by exams that mainly test vocabulary skills, not translation.
- Vocabulary learning cannot be modelled as memorising cross-lingual word pairs. Studies of lexical development must include separate aspects such as word formation, inflection, polysemy and phraseology.
- The specific requirements of learning Latin (no need for language production, low occurrence frequencies of each word) suggest to stop focusing on translation-specific skills and emphasise overall language skills instead.

3. Results

In the following section, some of the numerous results are presented. The selection is driven by the intention to give an overview of the diverse insights into Latin vocabulary acquisition gained over the course of the research project. Additionally, the manifold findings might allow a deeper understanding of the main problems in Latin classes when the students make great efforts but fail more often than they succeed.

3.1. Study with Intermediate Learners Based on a Text by Cicero

The results of the first study were interesting, but also disappointing because of the overall performance of the test group. Although this group had been assessed as cognitively less successful learners, the intervention should have shown at least a small improvement in dealing with the tasks of the tests. Yet, as it is shown in Figure 1, the test group did not accomplish a better score in the second test. While the control group improved their performance between the two tests by 16%, the test group achieved almost the same score in pre-test (18.24 points) and post-test (18.22 points). Some of the circumstances might explain this, e.g. the pre-test in the control group took place

after a strenuous class test (i.e. a weaker performance than usual), the study took place just before the summer break (i.e. grading with marks was no longer possible) and the teacher used the material of the intervention only in every second lesson. Nevertheless, this does not fully account for the results. Besides the necessity that an intervention has to focus more on just one or two aspects of vocabulary competence if it is running out of time, it is obvious that a long-standing cognitive disparity between two classes cannot be overcome in a short intervention. This disparity is best shown in Figure 2 and Figure 3. Whereas task 1B refers particularly to the language proficiency level in Latin, because students need to recognise the lexical form of the given words, the other task (3B) relies more on general, higher-order thinking skills like inferring a word meaning and explaining one's own procedure. The control group performs better in cognitively demanding tasks, but this ability does not help to surpass the other group in the Latin-specific task by an equally large margin. This is interesting as it might suggest that, at an early stage of second (foreign) language acquisition, even well-developed strategies cannot compensate for a reduced representation of a word in the mental lexicon. That being said, the results show above all that the Latin language level of both groups is very low even after learning Latin for almost five years.

Median: 38.89%; 51.11%; 41.11%; 60.00%. The control group in particular exhibits almost a normal distribution. Is also remarkable the big difference (approx. 20%) between the groups in the post-test.

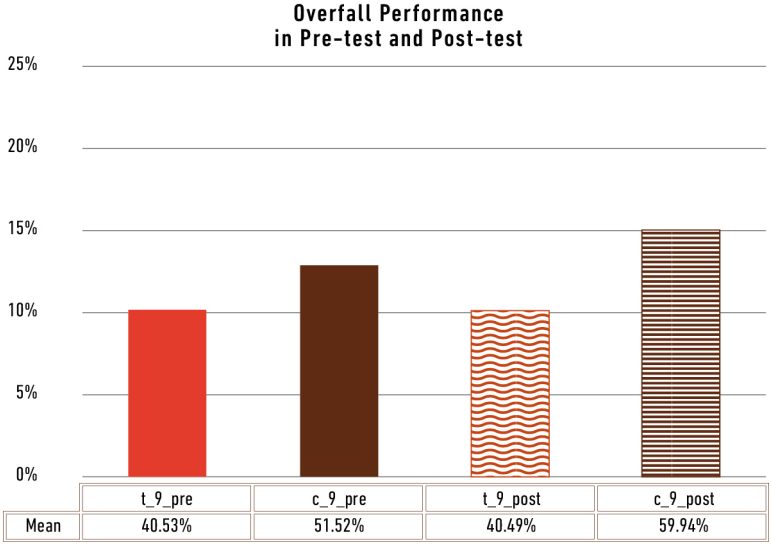


Figure 1. Relative averages (max.: 45 points)

The students' majority of both groups think that this Latin-specific teaching task is difficult. In both groups, the middle 50% achieve 1 to 3 points out of 5 in the pre-test (post-test: t = 1-3 points, c = 2-4 points). The language proficiency does not seem to differ much.

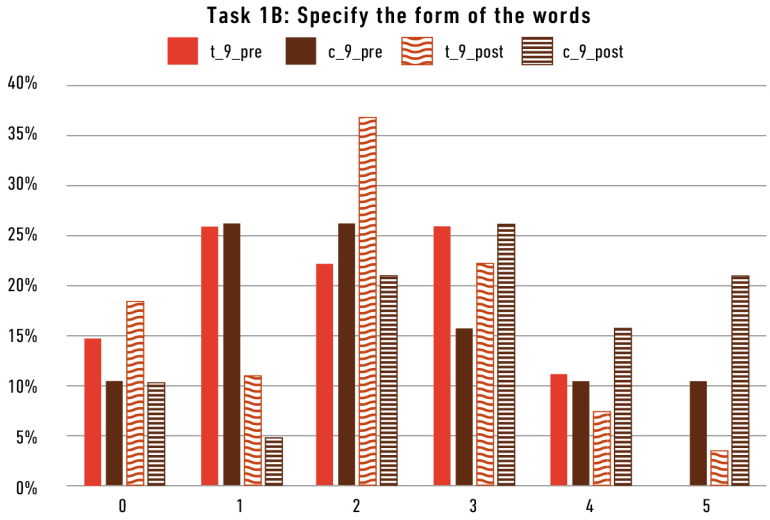


Figure 2. Frequency distribution of achieved scores (max. 5)

This task focuses on strategic language skills and does not require a certain Latin proficiency level. The control group performs much better, e.g. the median in the post-test is c = 3 (t = 1).

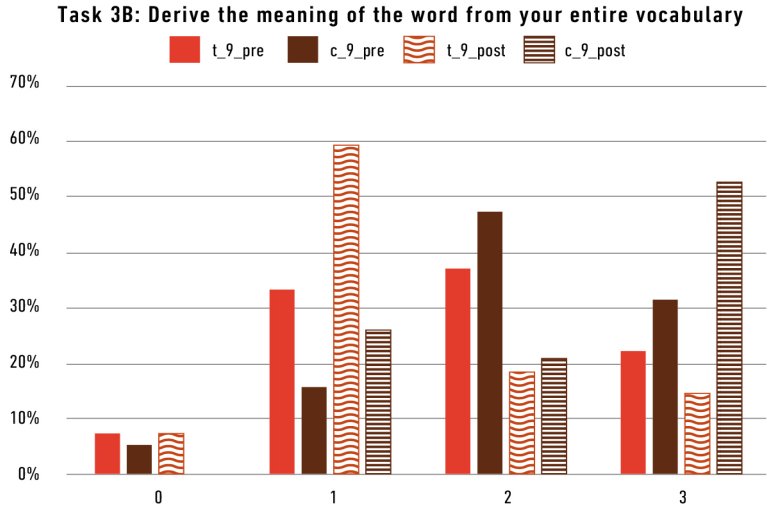


Figure 3. Frequency distribution of achieved scores (max. 3)

3.1.1. Interesting Linguistic Errors

Apart from the more or less disappointing quantitative results, a qualitative evaluation of the students' answers is productive in the sense of understanding the learning of a historical language like Latin better. For example, there is evidence that students are affected by interferences and overgeneralise when using language rules, as they would do when learning a modern language. Furthermore, they fail at various levels of the lexical representation of a word in the mental lexicon. Some of the most interesting findings are given in Table 4.

Table 4. Examples of the qualitative analysis of students' answers in both tests

Task (3A, Pool): Create compounds and translate them			
Student's answer	**Target hypothesis**	**English meaning**	**Type of error**
ab-scribere – abschreiben	abscribere is non-existent in Latin; ab-ducere	to lead away	Word formation rule of L1 (ab-schreiben – to copy) causes wrong association.
vide-tor – Seher	videtor is non-existent in Latin; scri[b/]p-tor	writer	Word formation rule of L1 (Seh-er – the seer) and a weak understanding of the German concept of Seher cause wrong association.
facil-iter – leichter	faciliter – leicht (adverb)	easily	Neglecting the part of speech; phonological form of L1 (leichter; comparative) causes wrong association.
Task (4B, 3 Pools): Construct a Latin phrase and translate it			
Student's answer	**Target hypothesis**	**English meaning**	**Type of error**
litteras scribere habeo – Ich habe Briefe geschrieben.	litteras scribere possum – Ich kann einen Brief schreiben.	I can write a letter.	Lexical form of L1 (ich habe geschrieben – I have written) causes wrong association, but L2 lexical form is built correctly (habeo) disregarding the participle.
litteras scribere debet – Briefe müssen geschrie-ben werden.	litteras scribere debet – Er/Sie muss einen Brief schreiben.	S/He has to write a letter.	Semantic-based understanding disregarding L2 form and a lack of awareness of active or passive voice in L1 cause wrong association.
nos epistulam videt – Er sieht unseren Brief.	nos epistulam scribimus – Wir schreiben einen Brief.	We write a letter.	Phonological or orthographic similarity to noster (unser) and a missing link to the part of speech of nos cause wrong association.

amicitia magnam est – Die Freund-schaft ist groß.	amicitia dignus est – Er ist der Freundschaft würdig.	He is worthy of friendship.	Semantic-based understanding disregarding L2 form causes wrong association.
Task (5A, Cloze): Give the appropriate German meaning.			
Student's answer	**Target hypothesis**	**English meaning**	**Type of error**
frater – Vater	Bruder	brother	Phonological or orthographic form of L1 (Vater) causes wrong association.

Though the intervention did not improve the performance of the test group quantitatively, the teacher's feedback was very positive. After working with the intervention material, she understood the necessity to spend time on vocabulary learning in class, but also suggested to integrate the tasks into the prepared text and shorten them as well, to avoid boring students with long-lasting exercises.

3.2. Study with Intermediate Learners Based on Texts by Ovid

For avoiding the ceiling effect (Sparrow, Newman, & Pfeiffer, 2005, p. 290), the tests were designed in a way that between 65% and 80% of the total score should have been achievable. On average, the students should reach 75-80% for the less complex tasks, e.g. 1 and 8, and only 65-70% for the linguistically and cognitively more demanding tasks, e.g. 2 and 9. Surprisingly, both groups did not exceed 60% on average and very few achieved more than 70% (5 students/pre-test, 6 students/post-test). In general, the test group achieved on average lower scores (Figure 4), but shows a growth in performance (mean: 10.83%; median: 12.33%). By contrast, the control group performs worse in the second test (mean: -3.62%; median: -7.15%). Since the median shows slightly higher growth rates than the mean value, it can be concluded that the respective changes were actually triggered by the majority and less by individual outliers of both groups. Thus, it seems that the intervention helped the weaker test group to perform better in the second test so that the difference in outcomes decreases by more than 6% and the output of the groups is converging. Despite these encouraging results with regard to the possible effect of the intervention, the question remains why both groups did not reach the expected 75-80% on average. However, apart from unknown confounding factors, the less common test formats focusing on metacognition and implicit knowledge, the scope of the tests or a lack of motivation on the part of the students could be among the potential causes for these results. Nevertheless, the analysis of the tasks seems to be helpful to understand better the difficulties that students have in learning Latin vocabulary. Consequently, four particularly interesting outcomes are presented in this context.

Median: 36.17%; 61.70%; 40.63%; 57.29%. After the intervention the test group performs in the post-test relatively better than the control group.

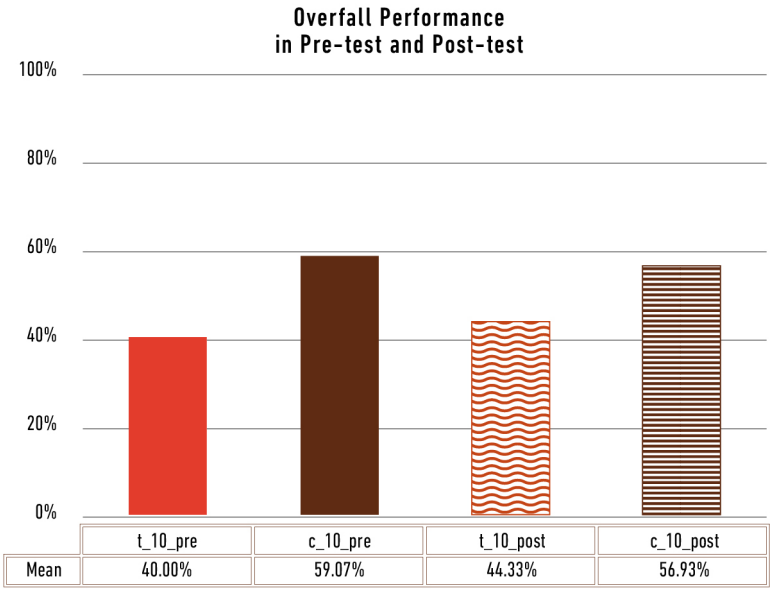


Figure 4. Relative averages of a maximum of 47 or 48 points

3.2.1. Task 1 and Task 2: Metre and Metacognitive Reflection

After practising metre (i.e., indicating syllable lengths in a hexameter) in the regular Latin class before this study started, both tasks should have been an easy introduction to the tests. Astonishingly, the results contradicted this assumption. Although the students rated the difficulty of both tasks as rather easy, they failed to achieve a high score on average. Despite the visible improvement between pre-test and post-test in task 1 (Median: 50.00%; 50.00%; 66.67%; 83.33%. Especially the development of the median indicates that the majority of all students achieve higher scores in the post-test than in the pre-test.

Figure 5), the students of both groups had problems with the second task that focuses on metacognitive understanding and German technical language to provide an answer. What is more, the generally high-performing control group obtained a remarkable growth rate (33%) in task 1, whereas the outcome of the test group changed by just 16%. That is notable, because it might suggest that both groups learned the metre just by practising in class, not by the tasks of the intervention. Consequently, it is recommendable to provide students with more explicit exercises for metre repeatedly. Furthermore, the results in

task 2 –in particular the overall failure of the control group (Figure 6)– call for more attention on metacognitive tasks within class so that the students have many opportunities to improve their metacognitive skills and, consequently, their overall language performance.

Median: 50.00%; 50.00%; 66.67%; 83.33%. Especially the development of the median indicates that the majority of all students achieve higher scores in the post-test than in the pre-test.

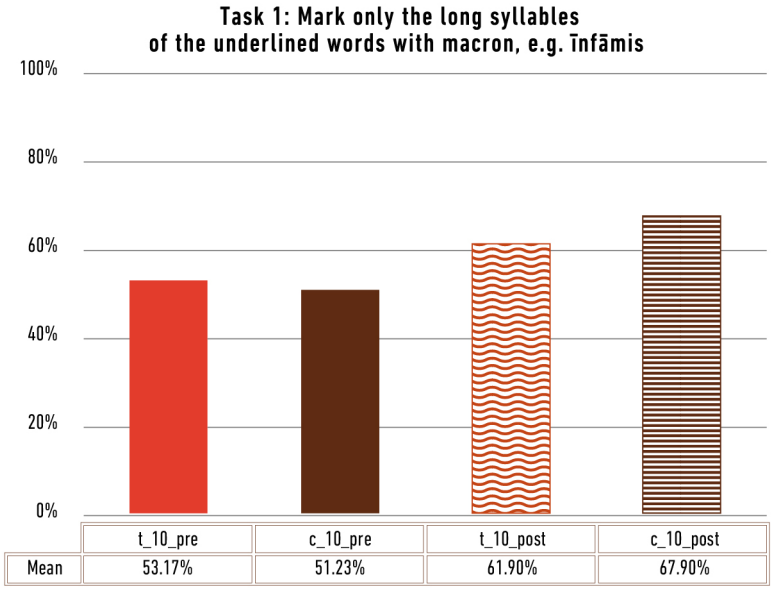


Figure 5. Relative averages of a maximum of 3 points

3.2.2. Task 8: Basic Form

This task asks for a basic skill that is assumed to be present without being tested by the teacher. The hypothesis that this skill is often not sufficiently acquired, however, is also supported by the study of Florian (2015), where students do not recognize an inflected word as the word already learned in the basic form, i.e. the appropriate dictionary entry is not found. Therefore, the results (Figure 7) are not as shocking and unexpected as they could have been: on average, the students could give just one basic form out of three that were asked for. Thereby, the findings including the assessment of the task as rather difficult by the students indicate that most students fail to lemmatise a word correctly or to retrieve for a given word relevant information from their mental lexicon. This conjecture is supported by the replies in the second part of the task. Even though some students could give smart answers like «*cupidine*

kommt von *cupidus*» (i.e. *cupidine* is derived from *cupidus*), most students who identified a basic form correctly gave no explanation, but the expression «gelernt» (i.e. learned). This can only lead to the conclusion that they were not able to use the context of the word or its morphology to deduce the basic form. The test results strengthen the perception that learners even after more than five years of learning Latin fail inevitably and quickly when trying to comprehend Latin words, sentences and texts, because most have only reached the lowest stage of language acquisition (cf. the SLA model of Jiang [2000]).

Median: 16.67%; 16.67%; 33.33%; 0.00%. The median is very striking. Whereas the majority of the test group performs better in the second test, more than half of the control group achieve 0 points in the post-test.

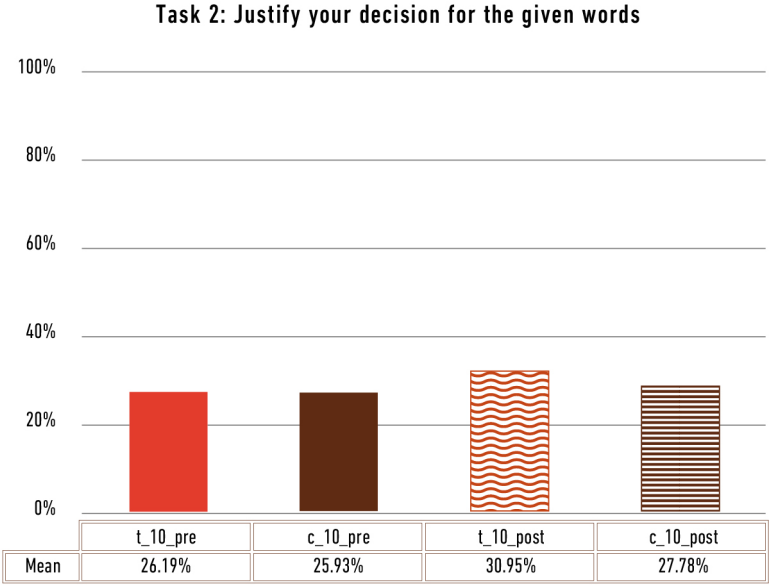


Figure 6. Relative averages of a maximum of 2 points

Median: 16.67%; 16.67%;16.67%;16.67%. The constant median shows that in general the small improvements in the second test are due to outliers who perform much better than at least half of all students.

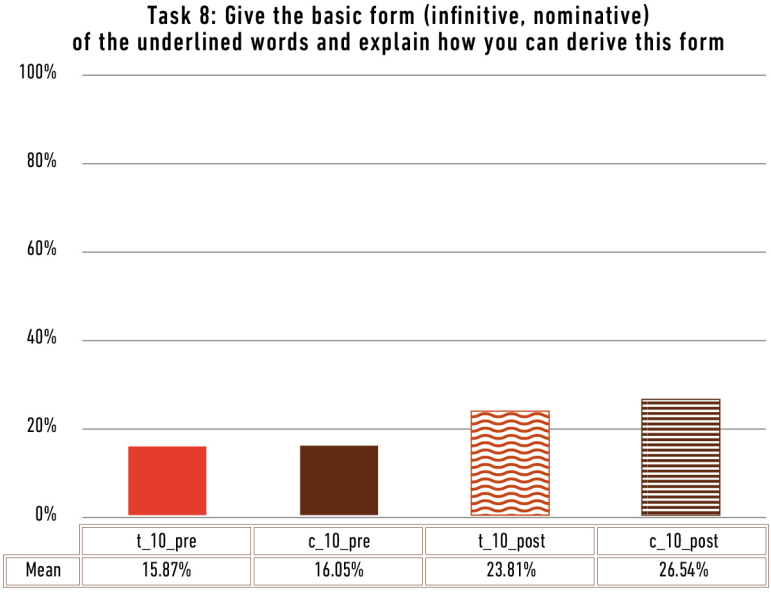


Figure 7. Relative averages of a maximum of 6 points

3.2.3. Task 9: Derivation of the Word Meaning

To solve this task students have to rely on (metacognitive) strategies when retrieving lexical information from their mental lexicon. The underlined words (pre-test: *mixta*, *iunguntur*, *facies*; post-test: *admovet*, *flectitur*, *facies*) are neither part of the above-mentioned 165 lemmata of the learning vocabulary nor totally unknown. Although the students declare this task rather difficult, even the usually low-performing test group achieves 42% in the pre-test (c = 73%) and improves its results in the post-test a little (48%, growth rate: 15%; Figure 8). This might indicate that the intervention helped the test group to perform better. However, what happened to the control group? The average score drops by almost 20% and is now only 54%. There might have been some confounding factors like a lack of working time (task 10 shows a similar decline). Nevertheless, another explanation is also possible, if one evaluates the answers given for the Latin word *facies* that is asked for in both tests. In the pre-test, 24 students of the control group know the word meaning and derivation, with very few erroneous associations. However, in the post-test only 10 students of this group are able to recall the meaning and the derivation. This might indicate that the word *facies* was «known» by chance in the pre-test, because it had been used previously.

Therefore, almost all students knew it (24 out of 27). By contrast, in the post-test only those students could answer correctly who really had learned the word and could recall it from the mental lexicon.

Median: 33.33%; 66.67%; 50.00%; 50.00%. The contrasting development brings both groups close together so that finally at least 50% of each group accomplish 50% (3 points) in the post-test.

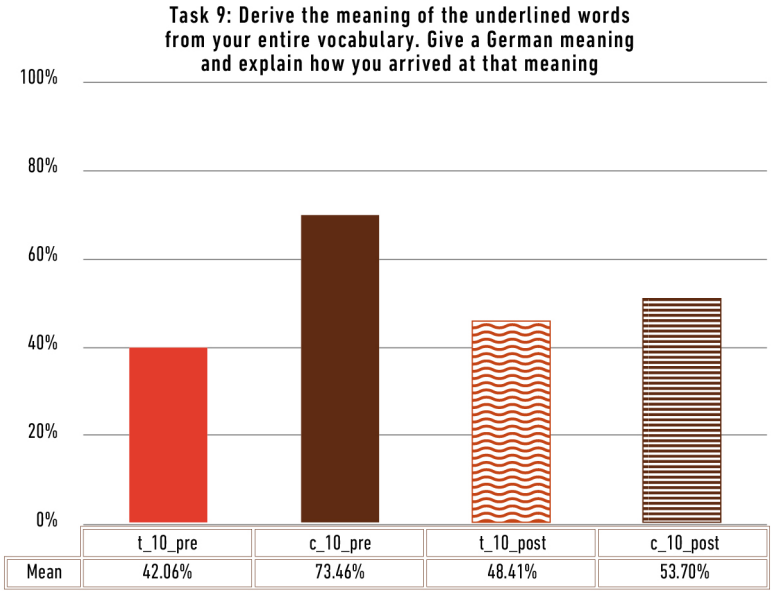
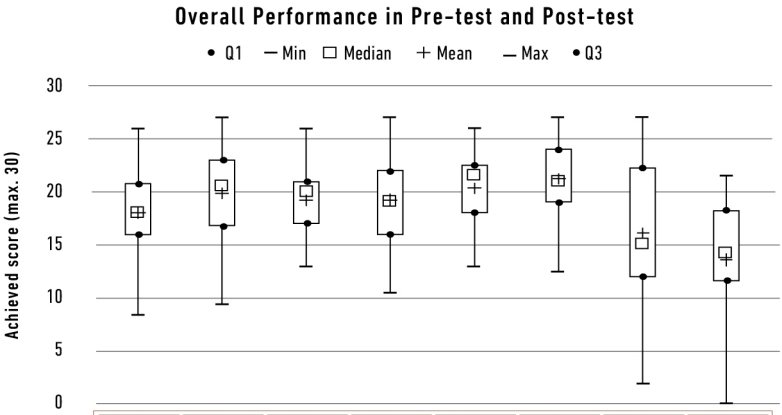


Figure 8. Relative averages of a maximum of 6 points

3.3. Study with Beginners Based on Textbook Material Relying on a DDL Concept

In general, the study can just vaguely point the way ahead for vocabulary work and learning in Latin classes. Because of the unmanageable confounding factors in an authentic educational context and the long period it took to complete, the correlation of test results and intervention is at most a weak one. The reading comprehension test mainly refers to an ability that is in great demand and intensely promoted during the first year at high school, since learning is increasingly carried out via texts. Thus, it is not entirely surprising that the overall performance of the studied groups reached a higher level in the post-test –with one exception (Figure 9). The results of the second control group (c2) cannot be included in the evaluation since the group obviously did not cooperate in the post-test.

Mean growth rate: t1= 10.38%; c1 = 0.21%; t2 = 4.28%; c2 = -15.16%. Median growth rate: t1 = 13.89%; c1 = -5.00%; t2 = -2.33%; c2 = -5.00%. For the groups t1, c1 and t2, the interquartile range increases. This might indicate that the students enhanced their skills in the first high school year answering the questions now more consciously by relying on learned facts and methods.



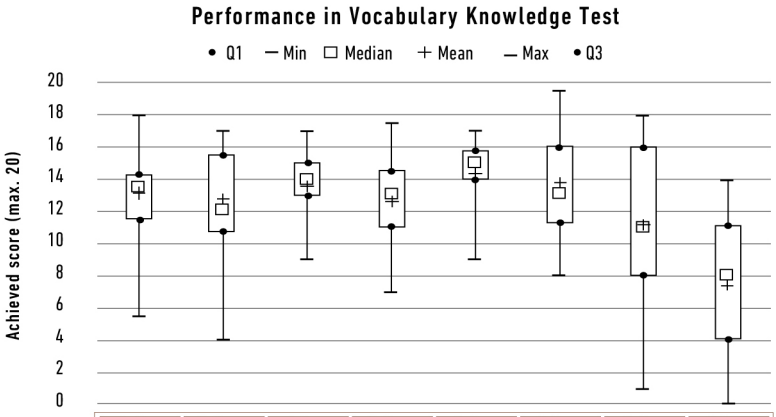
	t1_5_pre	t1_5_post	c1_5_pre	c1_5_post	t2_5_pre	t2_5_post	c2_5_pre	c2_5_post
Q1	16.00	16.75	17.00	16.00	18.00	19.00	12.00	11.63
Min	8.50	9.50	13.00	10.50	13.00	12.50	2.00	0.00
Median	18.00	20.50	20.00	19.00	21.50	21.00	15.00	14.25
Mean	18.02	19.89	19.16	19.20	20.35	21.22	16.08	13.65
Max	26.00	27.00	26.00	27.00	26.00	27.00	27.00	21.50
Q3	20.75	23.00	21.00	22.00	22.50	24.00	22.25	18.25

Figure 9. Distribution of achieved scores in general

However, as seen in Every group achieves a lower score on average, as the growth rates show: Mean growth rate: t1 = -3.93%; c1 = -7.37%; t2 = -4.26%; c2 = -34.08%. Median growth rate: t1 = -11.11%; c1 = -7.14%; t2 = -13.33%; c2 = -27.27%. Both the overall performance and the interquartile range increase considerably for t1, c1, and t2.

Figure 10, the general improvement is not due to the knowledge about vocabulary, but to the increased scores in the reading comprehension test (Figure 11). In a way, the higher scores of the reading comprehension were anticipated due to the increased practice of reading, but there is one striking feature: On average, both test groups achieved a higher score with a median of 75% (c1 = 65%, c2 = 63%). Furthermore, there are no extreme outliers anymore in both test groups. Considering the explicit training on context awareness the groups received in the intervention, this might suggest that more students in these groups were able to decode information by noticing the context.

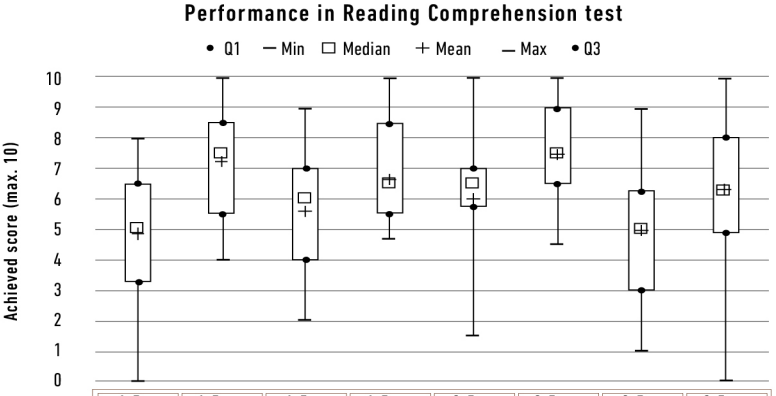
Every group achieves a lower score on average, as the growth rates show: Mean growth rate: t1 = -3.93%; c1 = -7.37%; t2 = -4.26%; c2 = -34.08%. Median growth rate: t1 = -11.11%; c1 = -7.14%; t2 = -13.33%; c2 = -27.27%. Both the overall performance and the interquartile range increase considerably for t1, c1, and t2.



	t1_5_pre	t1_5_post	c1_5_pre	c1_5_post	t2_5_pre	t2_5_post	c2_5_pre	c2_5_post
Q1	11.50	10.75	13.00	11.00	14.00	11.25	8.00	4.00
Min	5.50	4.00	9.00	7.00	9.00	8.00	1.00	0.00
Median	13.50	12.00	14.00	13.00	15.00	13.00	11.00	8.00
Mean	13.19	12.67	13.56	12.56	14.35	13.74	11.13	7.33
Max	18.00	17.00	17.00	17.50	17.00	19.50	18.00	14.00
Q3	14.25	15.50	15.00	14.50	15.75	16.00	16.00	11.00

Figure 10. Distribution of achieved scores in the vocabulary knowledge test

Every group achieves a higher score on average, as the growth rates show: Mean growth rate: t1 = 49.43%; c1 = 18.57%; t2 = 24.38%; c2 = 27.31%. Median growth rate: t1 = 50.00%; c1 = 8.33%; t2 = 15.38%; c2 = 25.00%



	t1_5_pre	t1_5_post	c1_5_pre	c1_5_post	t2_5_pre	t2_5_post	c2_5_pre	c2_5_post
Q1	3.25	5.50	4.00	5.50	5.75	6.50	3.00	4.88
Min	0.00	4.00	2.00	3.00	1.50	4.50	1.00	0.00
Median	5.00	7.50	6.00	6.50	6.50	7.50	5.00	6.25
Mean	4.83	7.22	5.60	6.64	6.00	7.46	4.96	6.31
Max	8.00	10.00	9.00	10.00	10.00	10.00	9.00	10.00
Q3	6.50	8.50	7.00	8.50	7.00	9.00	6.25	8.00

Figure 11. Distribution of achieved scores in the reading comprehension test

In contrast, there is no good explanation for the failure in the vocabulary knowledge test, in particular referring to the test groups. After focusing during the intervention on word fields, word formation, and technical language (among other things), at least the students of the test groups should have increased their scores. Instead, measured by the median, they performed as groups even worse than control group 1. In general, the variation grows in all three considered groups. That might indicate that the students became more heterogeneous with regard to their metacognitive abilities during the first high school year.

3.3.1. The Overall Performance of the Test Groups in Latin Classes

Comparing all results related to the given grades during the school year three facts are obvious (Figure 12 and Figure 13). First, the second test group gets better grades on average in the newly introduced DDL tests, the traditionally structured vocabulary (list) tests and the exams. Second, the performance of this group as measured by the received marks declines significantly in the second half of the year. Third, the students of the second test group appear to have more difficulties in handling the DDL tests compared to their success in learning word equivalents (vocabulary tests). By contrast, test group 1 performs more consistently. In particular, it is interesting that the variance measured for both vocabulary test types is almost the same (DDL: 0.56; voc: 0.57). Thus, it is likely that this group was able to adapt better to the new vocabulary test type over time as is also suggested by the comparison of the overall achievement in the DDL tests of both groups (Figure 14 and Figure 15).

Mean: DDL = 2.4; Voc = 2.1; Exams = 2.8; 1st half = 2.5; 2nd half = 2.5. Median: DDL = 2.4; Voc = 2.0; Exams = 2.8; 1st half = 3.0; 2nd half = 3.0

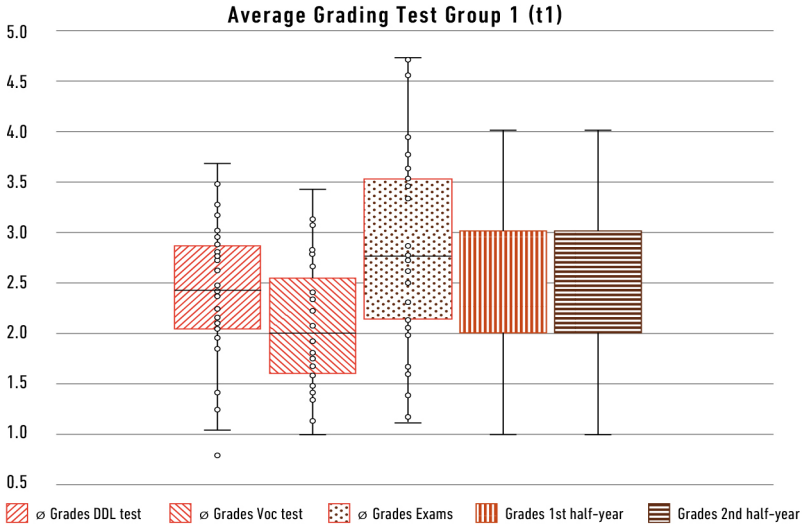


Figure 12. Distribution of achieved grades (t1)

Mean: DDL = 1.7; Voc = 1.7; Exams = 2.4; 1st half = 1.8; 2nd half = 2.2. Median: DDL = 1.7; Voc = 1.5; Exams = 2.2; 1st half = 2.0; 2nd half = 2.0

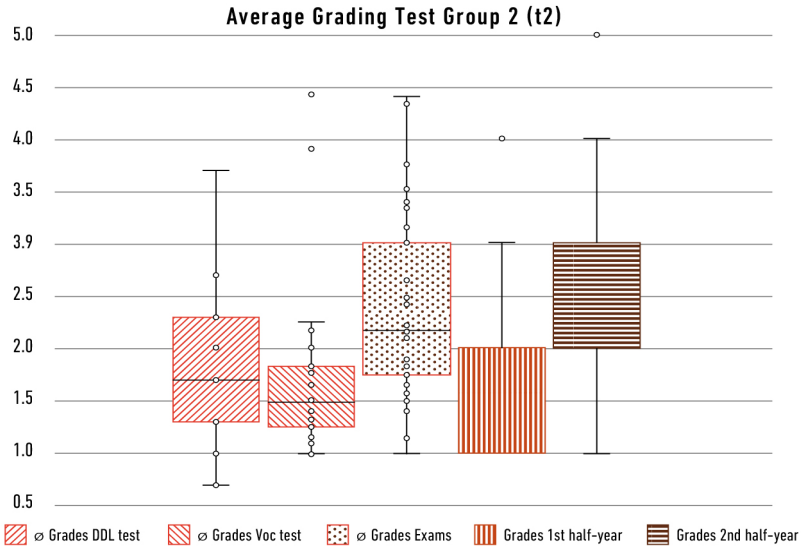


Figure 13. Distribution of achieved grades (t2)

Mean: 1 = 2.3; 2a = 3.1; 2b= 2.1; 3 = 3.4; 4 = 1.8; 5 = 1.9; 7 = 1.8; 8 = 2.5; 9 = 2.4 Median: 1 = 1.7; 2a = 3.0; 2b = 1.9; 3 = 3.3; 4 = 1.9; 5 = 1.7; 7 = 1.7; 8 = 2.7; 9 = 2.4 Test 8 contains an usual form of task 1 that the students could not solve: Give a synonym to … e.g. dat. (Test 6 is missing because there is no comparative value)

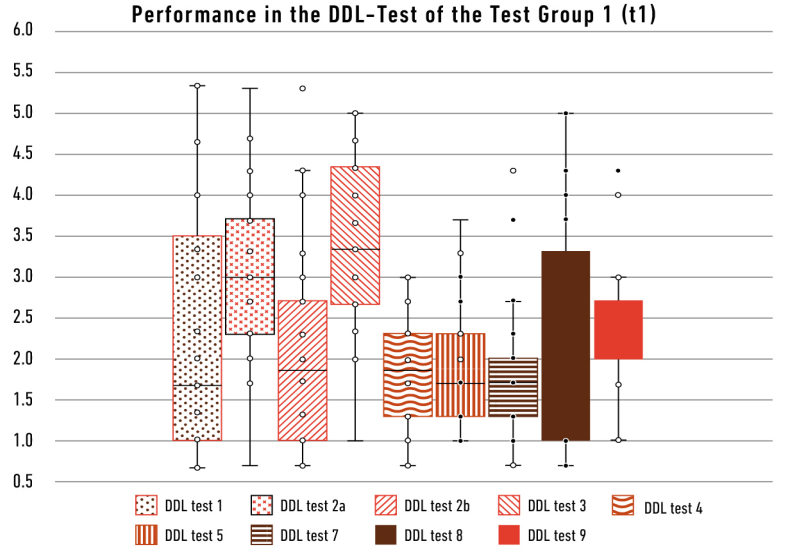


Figure 14. Distribution of grades per each DDL test

Mean: 1 = 1.5; 2a = 1.8; 2b= 1.2; 3 = 2.3; 4 = 1.5; 5 = 2.2; 7 = 1.5; 8 = 2.5; 9 = 2.3 Median: 1 = 0.7; 2a = 1.7; 2b = 0.7; 3 = 1.7; 4 = 1.3; 5 = 2.3; 7 = 1.0; 8 = 2.7; 9 = 2.0 Test 8 contains an usual form of task 1 that the students could not solve: Give a synonym to … e.g. dat. (Test 6 was cancelled due to reasons at school)

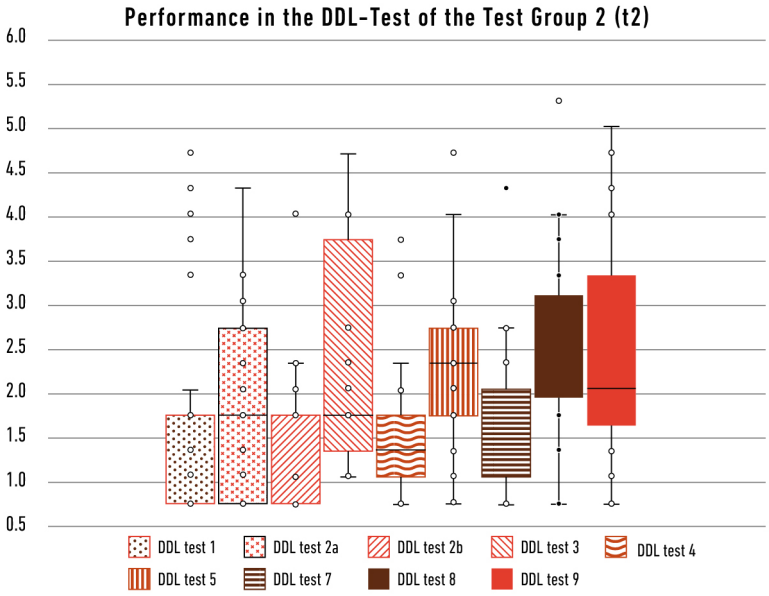


Figure 15. Distribution of grades per each DDL test

Starting with test 4, the results of the first group (t1) are approaching those of the other group in the second half-year, which might be attributed to a learning effect or a better motivation. However, although the reason for the improvement is uncertain, it is obvious that this new kind of vocabulary test is manageable even though it possibly takes time for the students to adjust to the new tasks.

3.3.2. The Latin Cloze Task in the DDL Tests

Usually, in a historical language like Latin, there is no need for language production though it would be advisable for better learning outcomes (Izumi, 2003). Therefore, students do not have to fill in Latin cloze tests, as a rule. The results in this test format are very interesting, as they might at least show whether the majority of (young) learners can handle a cognitively less demanding version of context-based language production: a Latin cloze with answers in a pool. Figure 16 and Figure 17 display for the cloze tasks of three tests the relative results for each task. In general, students of the first test group achieve a higher percentage and almost 80% of these students make at least two thirds of the possible scores. Thus, the group (t1) that performed worse at the

beginning of the intervention adapts successfully to the cloze task. Comparing these results to the average grades in the traditional vocabulary tests, it is informative that the second test group stays ahead of the other except for the first test. This might lead to the conclusion that both tasks (cloze vs. word list) are not correlated in the way that it would be possible to predict the outcome of a context-sensitive reading or translation task by evaluating the results of a test on translational equations. Although this does not seem surprising because of the procedures involved in retrieving answers from the mental lexicon, it is astonishing that this traditional vocabulary test type prevails. It does not seem to be very helpful for preparing complex tasks like decoding a Latin text nor does it enhance the understanding of the lexical form in the second language Latin.

Mean: test 5 = 89.51%; test 7 = 73.49%; test 8 = 67.89%. Median: test 5 = 100.00%; test 7 = 75.00%; test 8 = 75.00%. (100% each as maximum, numbers = students)

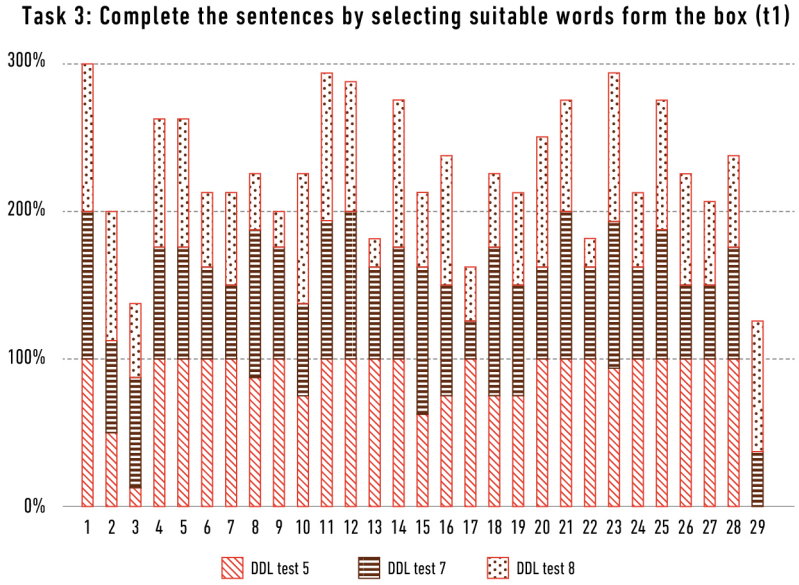


Figure 16. Relative results per DDL test, task 3 (t1)

3.4. Study with Intermediate Learners Based on the Vocabulary Unit

The results of the study indicate that participants who completed their tests very fast seem to reveal a higher level of vocabulary competence. Furthermore, these learners generally also made less mistakes, implying that advanced learners do not just produce better test results, but also need less time to do so (Beyer & Schulz, 2020, pp. 1753-1754). Apart from these less research-specific findings, there are signs of support for

the DDL approach. Larger markers indicate multiple students with the same percental change. Exercise IDs correspond to those in the learner dataset.

Figure 18 indicates that most participants of the intervention show no signs of improvement at all, suggesting that they either (1) already achieved the highest score or (2) failed completely in both the pre-test and the post-test. Typically, the former is the case, especially in a highly advanced learner group as the study group. While this case may be of little interest since there is hardly any opportunity for improvement except for presenting harder exercises, the cases that deviated in the post-test are much more remarkable: If there was a deviation, participants who learned with a vocabulary list generally changed for the worse, while those with a cloze usually improved their score. Even though it cannot be disputed that there are a few exceptions where cloze learners' performance slightly decreased, there is on the other hand only one example of a student learning with a vocabulary list who obtained a better result for a specific exercise in the post-test. Thus, in general, learning vocabulary in context seems to be correlated with better performance on the given vocabulary test.

Mean: test 5 = 68.53%; test 7 = 75.00%; test 8 = 64.87%. Median: test 5 = 75.00%; test 7 = 75.00%; test 8 = 68.75%. (100% each as maximum, numbers = students)

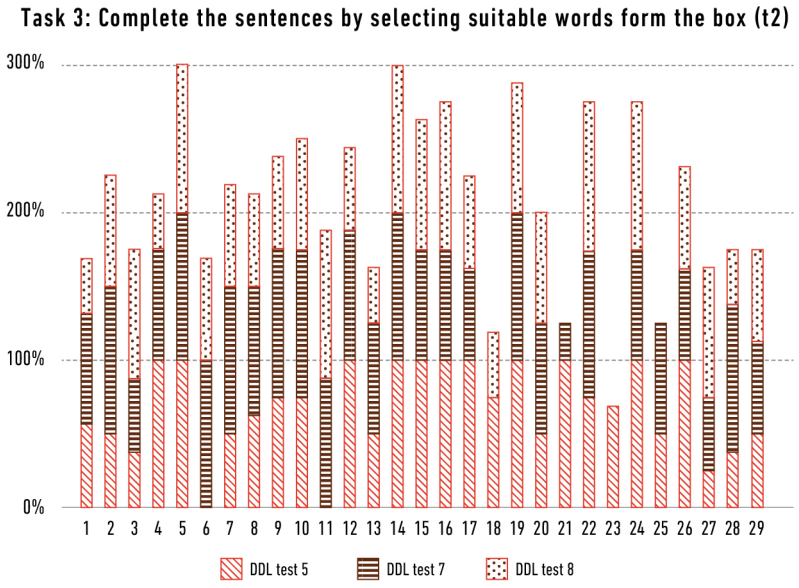


Figure 17. Relative results per DDL test, task 3 (t2)

Larger markers indicate multiple students with the same percental change. Exercise IDs correspond to those in the learner dataset.

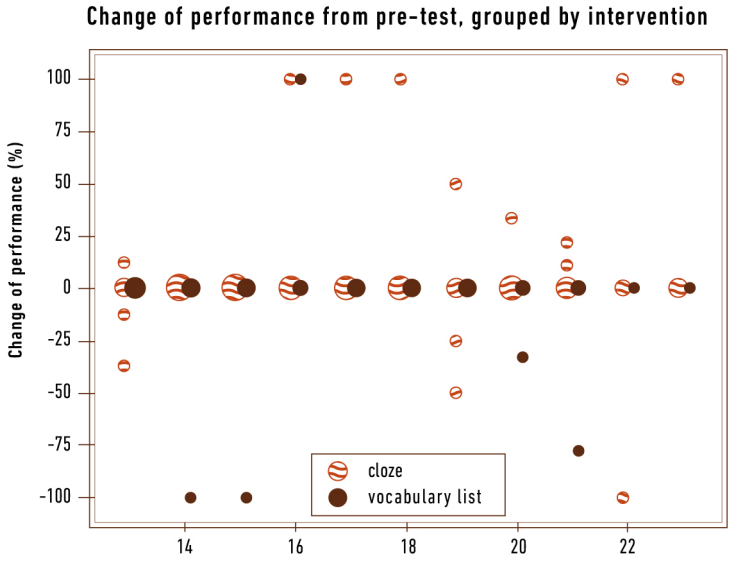


Figure 18. Comparison of students' performance before and after certain interventions

4. Conclusions

Overall, the studies allow some general remarks on testing Latin vocabulary in high school classes. First, the students' assessment of the task statements and difficulty proved to be helpful for the evaluation because it mostly matched the individual performance. Therefore, this kind of assessment should be included in tests and perhaps even in exams. Second, for a more precise evaluation it is imperative to split each task into the amount of operators and to assign the scores correspondingly, e.g. «Give the basic form. (1)» and «Explain how you derive it. (1)». Third, the metacognition skills also required for language acquisition are for most untrained students only available to a limited extent and are obviously further limited by a low level of language competence in German (technical) language, e.g. to reflect on why a syllable is long or to understand a task statement. Fourth, the feedback of the teachers suggests that students generally appreciate a vocabulary-focused classroom design, if it is diverse and helpful for solving the tasks in Latin classes, since they enjoy working with words. For this reason alone, vocabulary learning should take place in Latin classes regularly and variedly.

4.1. Language Proficiency

As was shown above, the causes of errors are similar to the ones when learning a modern language: Students tend to overgeneralise and to make inferences from L1 in sound, form and syntax (cf. ⁋0). Furthermore, the automation of retrieval processes from the mental lexicon is rarely successful, e.g. the recall of the basic form for a given word (cf. ⁋0). What is more, even though they have learned just a small amount of vocabulary (approx. 240 words), they have major difficulties to connect a Latin word with another Latin one, although both words were recently learned and discussed as synonyms, e.g. in the task «Give a synonym to … e.g. *dat*» (cf. ⁋0, test 8). All these examples illustrate a low outcome of Latin language acquisition, considering that these students have learned Latin for more than four years. Accordingly, their overall proficiency level reaches just a formal stage of lexical development (Jiang, 2000, p. 51) that is not sufficient for handling words in contexts or understanding texts. Consequently, this seems to lead to two major conclusions: Firstly, there has to be more diverse and regular vocabulary practice in class that enables students to achieve the second and third stages of language acquisition, i.e. L1 lemma mediation and L2 integration. However, since there is no need for language production and the occurrence frequencies of each word are low due to the different literary genres, the second and third stages might be difficult to reach in Latin classes. Secondly, if this assumption is correct, then it might be time to rethink the goals of learning Latin in high school, e.g. instead of focusing on Latin-specific skills needed for translation, it might be wise to focus more on overall language skills. By strengthening the students' knowledge about word formation rules and topical word associations, we may empower them to look up unknown words more efficiently, starting with a dictionary and then gradually moving more and more retrieval processes to their mental lexicon.

4.2. Methods for Learning and Evaluating Vocabulary

Due to the varied Latin literary texts the DDL approach has its limits, because students know less words in each text than what is necessary for incidental learning (95-98% should be known [Nation, 2013, p. 352]). Thus, the DDL approach in these studies refers to intentional learning by using context-based vocabulary exercises and introducing a broad understanding of vocabulary knowledge. However, this (corpus-based) language acquisition theory cannot be implemented by a mere contextualization of vocabulary tasks, but must be made explicit; otherwise, students do not learn to use the context for finding answers (cf. the bonus task in the Ovid study, ⁋0). Additionally, the results of the last two studies indicate that even young learners have no long-lasting problems with

context-based exercises (cf. [0]), adapt quite fast to these more complex tasks (cf. [0]), and perform better in context-based classroom activities like decoding a text after learning vocabulary in a context (cf. [0]). Thus, the DDL approach seems to be a promising way to design Latin vocabulary learning more attractively and to prepare the students more successfully for decoding Latin texts.

4.3. Consequences

In terms of the mental lexicon, Latin language acquisition is not different from learning a modern language (e.g. storage of information), but the words are less used and scarcely useful. Thus, students must feel the need to know a word (e.g. by comprehension tasks); otherwise, they learn the words just for tests and forget them instantaneously. In addition, they need a lot of diverse experience in dealing with vocabulary, e.g. learning rules of word formation, explaining their own actions or inferring a word meaning, to reach a higher level of language proficiency. For that reason, it is mandatory to work on vocabulary in class. Curricula need to reflect that change and allow for increased time spent on vocabulary acquisition, and teachers need to implement it accordingly, starting at their education in universities. According to this intensified and diverse vocabulary work in classes, the test formats should resemble the underlying broad understanding of vocabulary knowledge and competence. Therefore, some kind of the DDL tests should supplement the traditional vocabulary (list) tests. Consequently, if vocabulary is emphasised in class, the exams should equally shift their focus to more vocabulary tasks. Finally, to further the improvement of teaching Latin and to increase the outcome of learning Latin vocabulary, it is generally recommendable to conduct more hierarchically structured studies for modelling language acquisition in a historical language like Latin.

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