When students tackle grammatical problems: Exploring linguistic reasoning with linguistic metaconcepts in L1 grammar education[☆]

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ABSTRACT

When teaching grammar, one of the biggest challenges teachers face is how to make their students achieve conceptual understanding. Some scholars have argued that metaconcepts from theoretical linguistics should be used to pedagogically and conceptually enrich traditional L1 grammar teaching, generating more opportunities for conceptual understanding. However, no empirical evidence exists to support this theoretical position. The current study is the first to explore the role of linguistic metaconcepts in the grammatical reasoning of university students of Dutch Language and Literature. Its goal was to gain a better understanding of the characteristics of students' grammatical conceptual knowledge and reasoning and to investigate whether students' reasoning benefits from an intervention that related linguistic metaconcepts to concepts from traditional grammar. Results indicate, among other things, that using explicit linguistic metaconcepts and explicit concepts from traditional grammar is a powerful contributor to the quality of students' grammatical reasoning. Moreover, the intervention significantly improved students' use of linguistic metaconcepts.

1. Introduction

Since the beginning of the twenty-first century there has been a renewed interest in grammar teaching in L1 classrooms, both in research and in policy making (Hudson & Walmsley, 2005; Locke, 2010). This interest has become even more apparent in recent years, since the well-rehearsed argument emerging in the 1970s that grammar education has no impact on literacy development (e.g., Andrews, 2005; Elley, Barham, Lamb, & Wylie, 1975; Graham & Perin, 2007) is starting to crumble. While traditional parsing exercises generally fail to improve students' writing, there is a growing body of empirical evidence indicating positive effects of contextualized grammar teaching on writing development (e.g., Fearn and Farnan, 2007; Fontich, 2016; Jones, Myhill, & Bailey, 2013; Myhill,

Jones, & Lines, 2018; Myhill, Jones, Lines, & Watson, 2012; Watson & Newman, 2017).

Most grammar teaching in L1 contexts is still fairly 'traditional', in two distinct but related senses (cf. the systematic literature review of Van Rijt, De Swart, & Coppen, 2018). First, grammar in L1 contexts is mostly traditional in terms of its teaching approaches (e.g. focusing on rules, parsing isolated sentences, labelling parts of speech). Second, it is traditional in the sense that it uses a traditional body of grammar knowledge (e.g. structuralistic parts of speech terminology) – cf. Van Rijt and Coppen (2017). The term 'traditional' henceforth refers to both pedagogical and linguistic aspects of grammar teaching in this paper. Elements of these traditional aspects of school grammar can even be perceived in modern pedagogical approaches, such as Halliday's Systemic Functional Grammar (SFL) (Halliday & Matthiessen, 2004; see also Berry, 2016 and Myhill, 2018). For example, Jones and Chen (2012) and Macken-Horarik, Love, and Horarik (2018) report that teachers in Australia struggle with making connections between traditional grammatical terminology and rhetorical choices in writing, even though this is what the official ACARA curriculum, which leans heavily on functional grammar, demands of them. As a result, teachers resort to (more) traditional forms of grammar teaching. Much of the L1

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grammar teaching across the globe can therefore be considered traditional in either a pedagogical or a linguistic sense, or in both respects, even when a country's educational ideology promotes something different (Fearn and Farnan, 2007; Horn, 2003; Lefstein, 2009; Van Rijt et al., 2018; Watson, 2015). One of the main reasons why grammar education contends with a traditional image relates to teacher knowledge. Research shows that language teachers generally lack sufficient metalinguistic knowledge (e.g. Alderson & Hudson, 2013; Sangster, Anderson, & O'Hara, 2013; Van Rijt, Wijnands, & Coppen, 2019) and experience low self-confidence, even anxiety, in the linguistic domain (Giovanelli, 2015). Teaching grammar based on real insights rather than rules of thumb presents teachers with severe challenges, both when teaching grammar in isolation and when teaching grammar effectively in the context of writing (cf. Myhill, Jones, & Watson, 2013). Teaching grammar based on parsing isolated sentences puts less cognitive strain on teachers, who mostly lack the knowledge and confidence to teach grammar insightfully. Moreover, research into *teacher beliefs* has revealed that teachers generally tend to adopt teaching styles that match the content and pedagogies which they have experienced themselves as learners (e.g. Phipps & Borg, 2009; Watson, 2015). This way, more traditional forms of grammar teaching remain persistent in education. In addition, Van Rijt et al. (2018) found that the educational literature on L1 grammar teaching is not up-to-date with insights from modern linguistic theory, and predominantly addresses traditional grammatical concepts (e.g., subject, noun, and verb) rather than potentially useful (meta)concepts from modern linguistics (cf. Section 1.1). This is likely a result of current practice and policy, but it may also be indicative of a similar lack of linguistic knowledge for educational researchers.

It can therefore be concluded that both current grammar teaching and research into L1 grammar teaching are mainly traditional. Still, traditional grammar education is subject to much criticism (Giovanelli, 2015; Hudson, 2004), the main points of critique being that it focuses on rules of thumb and lower-order thinking rather than on real conceptual insights (Berry, 2015; Coppen, 2009; Myhill, 2000; Van Rijt et al., 2019) and that it is chiefly concerned with 'rules and compliance' and 'error eradication and notational rules' (Myhill, Jones, & Wilson, 2016; Myhill & Newman, 2016). Grammar education should rather be about talking and reasoning about language on an informed level. Understanding the relevant linguistic concepts and metaconcepts is one of the greatest challenges for grammar teachers (Fontich, 2016; Hulshof, 2013; Myhill, 2000; Ribas, Fontich, & Guasch, 2014). This holds for any kind of grammar education, whether its goal is to teach cultural knowledge, to develop students' literacies, to acquire a foreign language, or to stimulate reasoning skills (see Fontich & Camps, 2014 or Van Rijt et al., 2018). Such an understanding is even more important for students who study languages or linguistics at university, where they are expected to develop an academic expertise in this domain. What is more, a fair amount of these students will become teachers, who need a very sound grammatical knowledge in their language teaching (Alderson & Hudson, 2013; Giovanelli, 2016; Jones & Chen, 2012; Myhill et al., 2013; Sangster et al., 2013). The current study is set in a higher education context, although its relevance and implications extend well beyond higher education.

Some previous research has focused on traditional grammatical concepts in the context of writing education (e.g., Fontich, 2016; Myhill et al., 2012; Myhill & Newman, 2016; Watson & Newman, 2017). From these studies, it has become clear that a good subject knowledge of grammar is also essential for teachers in effectively making connections between grammar and writing. The studies cited above show that it is possible to teach traditional grammatical concepts without adopting traditional pedagogical means. However, making students reason or talk about traditional grammar in

writing remains difficult, since students find it hard to conceptually grasp linguistic metalanguage (Watson & Newman, 2017).

In line with this, some scholars have suggested that bridging the gap between linguistic theory and L1 grammar education can solve the problem of a limited conceptual understanding of grammar (e.g., Carter, 1982; Hudson, 2004; Mulder, 2010; Van Rijt & Coppen, 2017; Van Rijt et al., 2018), claiming among other things that (meta)concepts from modern linguistic theory can be used to strengthen traditional grammar education. For example, understanding the passive voice (a notoriously difficult grammatical structure, see Myhill, 2003), could benefit from an approach that focuses on the so called 'mapping problem' in the framework of Lexical-Functional Grammar (cf. Bresnan, Asudeh, Toivonen, & Wechsler, 2016), introducing modern linguistic metaconcepts such as *semantic roles*, which remain undiscussed in traditional grammar (see Van Rijt et al., 2018). Another example is how the metaconcept of *valency* can be used to distinguish between (more or less) obligatory and non-obligatory syntactic elements in a sentence (i.e., the difference between objects and adverbials) – see Perini (2015).

Although theoretically an approach uniting (meta)concepts from modern linguistic theory and traditional grammar education seems promising, no empirical evidence exists to prove its efficacy for linguistic reasoning skills or linguistic understanding (see Hulshof, 2013). The current exploratory study tries to fill this gap by investigating the effect of grammar education based on linguistic (meta)concepts on students' competence in grammatical reasoning and linguistic problem solving. More specifically, it examines whether a short intervention focusing on such metaconcepts in the context of traditional grammar has positive effects on the quality of students' grammatical reasoning.

1.1. Linguistic concepts and metaconcepts

When modern linguistic theory is turned to for enriching traditional school grammar, the question arises which (meta)concepts are suitable for this enrichment. Different linguistic schools (e.g. generative linguistics, cognitive/construction grammar, SFL) emphasize different aspects of sentence-level linguistics, holding different views on language acquisition and structure. To avoid adhering to any one particular linguistic school, and to benefit from the full width of modern linguistic theory, Van Rijt and Coppen (2017) have conducted a Delphi study among linguistic experts from different backgrounds. The experts reached a general agreement among on the 26 crucial (meta)concepts from the syntax-semantics interface. According to these experts, the 26 metaconcepts were very suitable for enriching school grammar, in which syntax plays a large role.[1]

Van Rijt and Coppen (2017) and Van Rijt et al. (2018) argue that a better conceptual understanding of grammar can be achieved by making these (theory-neutral) metaconcepts the target of grammar learning and instruction, with the important caveat that these concepts should not be used to completely replace the traditional grammatical terminology, but that they should instead be related to concepts from traditional grammar education (see also Mulder, 2010[2]).

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[1] The metaconcepts from Van Rijt and Coppen (2017) include both metaconcepts from modern linguistic theory as well as metaconcepts that can also be found in traditional grammar. The reason for this is that even though modern linguistics has generated several new insights, these mostly build upon and expand the more traditional metaconcepts (cf. Van Rijt et al., 2018) – cf. Allan (2007).

[2] The importance of not simply replacing one set of grammatical concepts for another cannot be overestimated (Mulder, 2010). It would be unrealistic to assume that traditional grammatical terminology, which has existed since classical antiquity (see Seuren, 1998), could suddenly be replaced by a more modern set of concepts, since this will lead to severe clashes with the existing grammar education (see Van

Following Kimball (2007), *concepts* can be defined as 'abstract realities of the mind' (see also Lipman, 2003, p. 181), whereas *metaconcepts* can be defined as '[...] the mind's generalized representation of one or more concepts'. In other words: meta-concepts are concepts with an overarching value, which can be used for conceptualization or rational deduction, mediating students' understanding of underlying subject-specific concepts (Van Drie & Van Boxtel, 2008; Van Rijt et al., 2018). In grammar education, for instance, 'valency' could be considered a metaconcept, which can be used to enhance understanding of other grammatical concepts, such as direct and indirect objects. In another example, the metaconcept of *modality* could be used as a meaningful over-arching metaconcept to discuss traditional concepts such as *modal adverbs* and *modal auxiliaries*.

According to Gombert (1992, p. 191), metalinguistic understanding encompasses two types of relevant knowledge: declarative knowledge, which is the knowledge regarding grammatical content, and procedural knowledge, which is the ability to effectively work with this knowledge. Declarative and procedural knowledge are mutually intertwined (see also Moseley et al., 2005), and thus both required in effective grammar education. Ribas et al. (2014) make a similar assumption in saying that '(...) there are close ties between grammatical concepts and studying and reflecting procedures, and that the latter are not merely an unimportant, superficial part of the way language is perceived and language knowledge is constructed' (2014, p. 15).

In the current study, it is assumed that the declarative knowledge of grammar should entail more than just the concepts from traditional grammar, but also (meta)concepts from modern linguistic theory. It is also assumed that the concomitant procedural knowledge should involve more than just the rules of thumb and audit questions that are dominant in traditional grammar education. Rather, working with modern linguistic (meta)concepts requires a type of reasoning that is more common for linguistic experts (Fontich & García-Folgado, 2018, p. 31; Honda & O'Neil, 2007; Kuiper & Nokes, 2014, Ch. 1; Tallerman, 2015). When linguists are trying to grasp a syntactic structure, they will try to syntactically manipulate the sentence under scrutiny, for instance by constructing an analogous example, by topicalizing constituents or by verifying whether a certain element can be omitted. This repertoire of linguistic reasoning components is crucially important for linguists trying to describe the language reality, because although traditional grammar education suggests otherwise, most real-life sentences cannot be parsed or analyzed unambiguously (Coppen, 2009), in part because conceptual categories themselves are sometimes 'fuzzy' (Kuiper & Nokes, 2014). The present study is focused on grammar teaching per se, independent of any contextualization. Therefore, findings are also of importance in more contextualized approaches to grammar (see discussion section).

1.2. The current study

There are good theoretical grounds to assume that a pedagogical approach to grammar teaching targeting linguistic metaconcepts and linguistic reasoning is crucial for a deeper understanding of the subject matter. The current study is the first to empirically explore the role of both linguistic (meta)concepts and appurtenant linguistic reasoning in L1 grammar education, focusing on univer-

sity students of Dutch Language and Literature. We aimed to answer the following research questions:

(1) What are the characteristics of students' grammatical problem solving in terms of their grammatical or linguistic (meta)concept use (declarative knowledge) and their linguistic reasoning strategies (procedural knowledge)?
(2) What characterizes good quality grammatical reasoning?
(3) What is the effect of a short intervention aimed at fostering linguistic metaconcepts and linguistic manipulations on students' grammatical reasoning?

2. Method

2.1. Participants

24 first year students of Dutch Language and Literature from a large university in the Netherlands (9 males) voluntarily participated in the study. All students signed a consent form in which they stated that their data could be used for scientific research anonymously. In addition, the department of Dutch Language and Literature approved of the investigation. In the pre-test, 23 students participated due to the illness of one student. In the post-test, 22 students took part (again with drop-outs due to illness). For the measurements that relate to the effect of the intervention, only the data from students that were present at both the pre- and post-test could be taken into account. In all other measurements, all available data was taken into account.

2.2. The intervention

In total, students were exposed to twelve hours of contact time in the intervention, consisting of a mixture of lectures and seminars. Prior to each seminar, an assignment had to be submitted which consisted of reasoning tasks that were aimed at applying the declarative and procedural knowledge described in the present paper. The intervention the students participated in was designed in such a way that metaconcepts from modern linguistic theory would be the focus of the course, making appropriate connections between them and traditional parts of speech. The intervention focused on four somewhat related metaconcepts: *predication* (cf. van Eynde, 2015), *valency* (cf. Perini, 2015), *complementation* (Perini, 2015) and *modification* (cf. Morzycki, 2015), although if the occasion called for it, other metaconcepts were taken into account as well. Several more modern concepts, related to these metaconcepts, were also introduced, involving concepts such as *agent, patient, argument* and *adjunct*. These concepts can all be used well to enrich understanding of traditional parts of speech. All main traditional parts of speech were covered in the intervention. (See e.g., Tallerman (2015), or Van Rijt and Coppen (2017) for general explanations of the concepts from the intervention.) In Appendix 1, an overview of the intervention is given.

Finally, the second author of this paper, who acted as the interventions' instructor, also paid attention to linguistic reasoning in the form of good practices, demonstrating how linguists apply and combine subject-specific procedural and declarative knowledge.

The intervention was implemented in the first term of the academic year, meaning that students only had their knowledge from secondary school Dutch as a basis. After finishing pre-university secondary education, students are expected to master Dutch at a level that is comparable to the C1 level of the Common European Framework (but see endnote 3).

Rijt et al., 2019). Moreover, according to Van der Aalsvoort and Kroon (2015) it is of great importance that teachers do not feel 'overruled' by academics, who sometimes hold different views on which content should be considered important. Instead, academics and teachers should join forces and opt for a state of *cooperation*, in which the academic discipline and the related school subject can mutually benefit from one another.

2.3. Pre-test and post-test

Prior to and after the intervention, the participating students individually tackled a set of grammatical problems consisting of sentences that could, in principle, not be analyzed unambiguously in traditional grammar, or they had to explain why one sentence could be considered grammatical, whereas another one could not (e.g., *Jan regent nat* ('Jan is raining wet', in literal translation) versus *Jan regent** (*'Jan rains'). In the case given, only *het* ('it') can be combined with the verb *regenen* ('to rain') in Dutch, unless a complement is added, in which the adjective *nat* ('wet') is predicated of *Jan*. *Nat* is a secondary predicate in such cases, and the construction as a whole receives a resultative interpretation, meaning that it rains in such a way that Jan becomes wet (cf. Broekhuis & Corver, 2015, p. 239) – something that cannot be effectively explained in traditional school grammar, in which metaconcepts such as predication and complementation play no role. See Appendix 2 for a short overview of the grammatical problems that students had to tackle. In both the pre- and post-test, students were invited to solve four grammatical problems as extensively as possible, two of which were designed in such a way that they could elicit the metaconcepts from the intervention, whereas the other two problems were filler items that related to grammatical phenomena that were too advanced for the students to tackle, since they dealt with topics they had not yet been educated in (e.g., binding). The filler items were meant to measure whether any increase or decrease in progress could not simply be attributed to a general increase in cognitive ability. To nullify any effects related to the difficulty or order of the tasks, the group was randomly divided in two and the pre- and post-test items were counterbalanced (Shadish, Cook, & Campbell, 2002, p. 109). The post-test was conducted five weeks after the pre-test. Students submitted their data online, via Qualtrics. In total, this led to 180 student reasonings about grammatical problems, 90 of which related to target items, and 90 related to filler items.

2.4. Quality of students' reasoning

To assess the quality of the students' reasoning, an independent panel consisting of four experienced (full) professors of Linguistics was asked to individually rate the reasonings on a Likert scale, ranging from 1 ('very poor') to 5 ('excellent'). These professors were not informed of the aim or context of the study, nor were they aware that an intervention had taken place. To rule out any possible order effects, the order of student analyses was completely randomized for each of the rating professors. To assess the inter-rater reliability, a two-way mixed, absolute, average-measures intra-class correlation (ICC) was used (McGraw & Wong, 1996). The resulting ICC can be considered good (ICC = .70), (see Cicchetti, 1994), indicating a high degree of agreement among raters.

2.5. Qualitative analysis of students' reasoning

The student reasonings were analyzed qualitatively and inductively (cf. Cohen, Manion, & Morrison, 2011; Strauss & Corbin, 1990) to avoid missing any relevant data, following the constant comparison method. The first and fourth author of the current paper first engaged in open coding via Atlas.ti, aiming to capture any possibly relevant data regarding grammatical concepts and linguistic reasoning. The analysis was guided by sensitizing concepts (cf. Bowen, 2006) from traditional grammar and the metaconcepts from Van Rijt and Coppen (2017). Once the open coding had been completed, we iteratively and systematically re-examined our prior coding to achieve consistency. Both researchers reached absolute agreement on the coding, solving any differences in opinion through discussion. In the next stage, axial coding clustered the data into thematic groups.

For the linguistic (meta)concepts, we distinguished between explicit occurrences and implicit occurrences. If a student would describe a particular concept in detail without labelling it, it was coded as an implicit mention, allowing us to measure the effects of explicit metalinguistic knowledge versus implicit metalinguistic knowledge. A typical example is that students would sometimes refer to 'the person carrying out the action', which we coded as an implicit reference to the concept of *agent*. In the present study, therefore, it is assumed that declarative knowledge can manifest itself both implicitly and explicitly.

For each of the 180 student reasonings, the number of times a code occurred was registered. Finally, for each reasoning it was determined whether its main focus was on meaning (semantic) or on form (syntactic). An example of a prototypical reasoning with a semantic focus is: '*Jan* is the subject, and in this sentence it appears as if though Jan was raining. This is anatomically impossible. It is however possible for Jan to become wet due to the rain.' A prototypical example with syntactic focus is: 'The verb *to rain* normally does not go accompanied with a subject complement, since *to rain* is normally never a linking verb. In the sentence *Jan is nat*, which is less marked, *nat* does form a logic subject complement. *Zijn* is a linking verb in that sentence.'

2.6. Analysis of good quality grammatical reasoning

To analyze which variables were most strongly related to the quality of students' grammatical reasoning, multiple regression analyses were carried out. Because the grammatical reasonings are nested within students, a multilevel design was adopted which allowed for a random effect of students on the intercept and with a fixed slope. This design was used because it was assumed that there may be differences between students, but that the effect of the various types of declarative and procedural knowledge is similar for all student reasonings. The ICC indicated that 11.67% of the variance in grammatical reasoning ability can be explained by differences between students. This percentage is sufficient to adopt a multilevel design for the multiple regression.

First, we examined which types of declarative knowledge could best predict the quality of students' reasoning, taking into account both implicit and explicit concepts. Second, variables related to procedural knowledge were the target of a separate multiple regression analysis. Finally, the significant predictors of these two models were combined to generate the best possible predicting regression model. In all of these steps, a random effect of student on intercept was taken into account.

2.7. Analysis of the effect of the intervention

To measure whether the intervention had a significant impact on the general quality of students' reasoning, independent samples *t*-tests were undertaken. Independent samples *t*-tests were also used to determine whether the intervention could evoke significantly more metaconcepts in the students' reasoning. Given the fact that these students have experienced years of traditional grammar education, it is not unthinkable that metaconcept use cannot be stimulated in a short intervention, especially given that the intervention did not resemble their previous experiences in explicit grammar instruction.

Additionally, using chi-squared tests, it was tested whether students focused more on syntax than on semantics in the post-test compared to the pre-test.

Table 1
Axial codes with examples from the data.

	Example of open code(s) related to axial code	Example from data
Linguistic (meta)concepts (declarative)		
Traditional grammatical concepts	Subject, preposition, etc.	[. . .] It is strange that 'Jan'is the **subject** in this sentence [. . .]
Modern grammatical concepts	Agent, argument, adjunct, etc.	To rain is an intransitive verb, and does not call for a human **agent**.
Metaconcepts	Valency, predication, modification, etc.	Raining has a **valency** of 0.
Linguistic reasoning strategies (procedural)		
Rules of thumb	Audit question, rule of thumb	[. . .] If you subsequently ask the **question** 'what has Jan walked?' the answer is 'a round'.
Inferences	Simple deductions, correlations	'If X is omissible, it is an adverbial'.
Linguistic manipulations	Topicalization, replacement, constructed examples, etc.	'If you would use the verb in an **abstract manner**', you would get a structure like 'something tastes of something'.

3. Results

3.1. Characteristics of students' analyses

The overall quality of students' reasoning varied from 1 to 4.5 ($M = 2.44$, $SD = 0.75$). A prototypical example of a poor analysis (mean score 1.50) is the following: 'I think X is a direct object. The answer to the question 'who or what walks Jan' is namely X.' (Translation by the authors.) Such an analysis is characterized by the application of an audit question without any further reflection or consideration. Moreover, the analysis reveals a general lack of conceptual understanding.

An example of a good analysis (mean score 4.00):

'The verb *to walk* is monovalent. In sentence 1, a semantic role is served out to 'Jan', making this sentence grammatically correct. In sentence 2, the predicate is 'stuklopen'. This verb is divalent (SOMEONE WALKS SOMETHING BROKEN). 'Jan' again receives a role. The other role goes to 'his shoes'. This sentence too is therefore grammatically correct. In sentence 3, the predicate is 'to walk', just as in sentence 1. Here, there are however two constituents requiring a role: 'Jan' and 'his shoes'. Subsequently, this sentence is ungrammatical.'

In this analysis, an explanation is given based on linguistic concepts (valency patterns, a subcategorisation frame and semantic roles), which are actively used in the reasoning. Moreover, the student comes to a clear conclusion based on the application of these concepts.

The student reasonings counted an average of 50.41 words ($SD = 26.99$, range $= 14$–143). In the pre-test, students wrote an average of 51.59 words ($SD = 29.22$), whereas in the post-test, the number of words used averaged at 49.28 ($SD = 24.78$). There was no significant difference between these measurements in terms of the number of words used ($t(178) = .57$, $p = .57$).

Qualitative analysis resulted in a series of open codes, which were reduced and related to one another by axial coding (cf. Table 1). This revealed three main types of linguistic concepts and three types of linguistic reasoning strategies.

In Table 2, a quantitative overview is given of the occurrence of the various types of axial codes, both for declarative and procedural knowledge. In Section 3.3, a detailed overview of the differences between the pre-test and post-test is given.

For each student reasoning, it was also determined whether the main focus was on meaning (semantic) or on form (syntactic). In total, 84 reasonings were characterized as having a semantic focus, and 72 reasonings were judged to have a syntactic focus. 24 analyses had no clear focus on either syntax or semantics.

Table 2
Overview of the number of axial codes for student reasonings ($n = 180$).

	Total number of occurrences	Mean number of occurrences per student reasoning (SD)
Declarative knowledge		
Traditional explicit	400	2.22 (1.62)
Traditional implicit	8	0.04 (0.21)
Modern explicit	30	0.17 (0.49)
Modern implicit	49	0.27 (0.63)
Metaconcepts explicit	99	0.55 (1.06)
Metaconcepts implicit	89	0.49 (0.65)
Procedural knowledge		
Rules of thumb	50	0.28 (0.53)
Inferences	120	0.67 (0.73)
Linguistic manipulations	60	0.33 (0.59)

Table 3
Multiple regression analysis (multilevel) of declarative knowledge types.

	b (SE)	95% CI	p
Modern explicit	−0.05 (0.11)	−0.25, 0.16	.65
Modern implicit	0.16 (0.08)	0.01, 0.31	.04[*]
Traditional explicit	0.11 (0.03)	0.05, 0.17	.000[**]
Traditional implicit	0.45 (0.23)	−0.01, 0.91	.06
Metaconcepts explicit	0.31 (0.05)	0.22, 0.41	.000[**]
Metaconcepts explicit	0.03 (0.08)	−0.12, 0.17	.71

[*] Significance at the <.05 level.
[**] Significance at the <.001 level.

3.2. Analysis of characteristics of good quality student reasoning

A multiple regression analysis was conducted with the various types of declarative knowledge as predictors and the quality of students' reasoning as the dependent variable. The relationship between predictors and reasoning quality did not show significant variance in intercepts across students, Var(u_0j) = 0.02, χ^2 (1) = 1.39, $p = .24$. Table 3 provides an overview of the fixed effects in the model. Three variables in this model significantly predicted reasoning quality: the use of implicit concepts from modern linguistics ($F(1,175.88) = 4.46$, $p < .05$), the use of explicit concepts from traditional grammar ($F(1,168.74) = 13.07$, $p < .001$), and most strongly, the use of linguistic metaconcepts ($F(1,176.66) = 42.20$, $p < .001$). The other predictors included in the model did not significantly predict reasoning quality.

A second multiple regression analysis was carried out with the various types of procedural knowledge as predictors and the quality of the students' grammatical reasoning as the dependent variable. The relationship between these predictors and reasoning quality

Table 4
Multiple regression analysis of procedural knowledge types.

	b (SE)	95% CI	*p*
Rules of thumb	−0.05 (0.10)	−0.24, 0.14	.58
Inferences	0.26 (0.07)	0.12, 0.41	.000[**]
Linguistic manipulations	0.29 (0.09)	0.12, 0.46	.001[**]

Significance at the <.05 level.
[**] Significance at the <.001 level.

Table 5
Multiple regression analysis combining declarative and procedural knowledge.

	b (SE)	95% CI	*p*
Metaconcepts explicit	0.28 (0.04)	0.20, 0.37	.000[**]
Traditional explicit	0.08 (0.03)	0.02, 0.14	.007[**]
Modern explicit	0.14 (0.07)	−0.001, 0.29	.051
Linguistic manipulations	0.23 (0.08)	0.08, 0.39	.004[**]
Inferences	0.22 (0.06)	0.10, 0.35	.001[**]

[**] Significance at the <.001 level.

Table 6
Differences between pre-test and post-test.

	Pre-test		Post-test	
	Mean	SD	Mean	SD
Overall quality score	2.37	0.76	2.51	0.74
Target item quality score[**]	2.10	0.70	2.58	0.84
Filler item quality score	2.65	0.71	2.44	0.63
N of explicit metaconcepts[**]	0.19	0.50	0.89	1.32
N of implicit metaconcepts	0.45	0.66	0.53	0.64
N of explicit traditional concepts	2.38	1.53	2.08	1.70
N of implicit traditional concepts	0.05	0.21	0.04	0.21
N of explicit modern concepts	0.10	0.43	0.23	0.54
N of implicit modern concepts	0.34	0.71	0.21	0.55
N of rules of thumb[**]	0.39	0.62	0.17	0.41
N of linguistic manipulations	0.35	0.64	0.32	0.53
N of inferences	0.68	0.68	0.65	0.69

[**] Significance at the <.001 level.

did not show significant variance in intercepts across students, $\text{Var}(u\_0j) = 0.03$, $\chi^2(1) = 2.24$, $p = .13$. Table 4 provides an overview of the fixed effects in the model. Two variables in this model significantly predicted reasoning quality: the use of inferences as a reasoning strategy ($F(1,179.99) = 13.83$, $p < .001$) and linguistic manipulations ($F(1,179.98) = 10.83$, $p < .001$). Using rules of thumb did not significantly predict reasoning quality.

The third multiple regression analysis combined the significant variables of the two previous models to generate the best possible multiple regression model (Table 5). The relationship between these predictors and reasoning quality did not show significant variance in intercepts across students, $\text{Var}(u\_0j) = 0.02$, $\chi^2(1) = 1.33$, $p = .25$. Table 5 provides an overview of the fixed effects in the model. All variables except the implicit use of modern linguistic concepts remained significant predictors of reasoning quality.

3.3. Effect of the intervention

To get an idea of the differences in students' grammatical reasoning prior to and after the intervention, Table 6 lists the main differences between the pre- and post-test.

To measure whether students' reasoning improved due to the intervention, various independent samples *t*-test were undertaken. Students' reasoning showed significant progress on the target items ($n = 90$) in the post-test ($t(88) = 2.97$, $p = <.001$, $d = 0.62$), whereas the filler items revealed no significant changes in student reasoning compared to the pre-test ($t(88) = 1.47$, $p \leq 0.15$).

Figs. 1 and 2 reveal the individual progress students have made from pre- to post-test. Fig. 1 illustrates that the significant
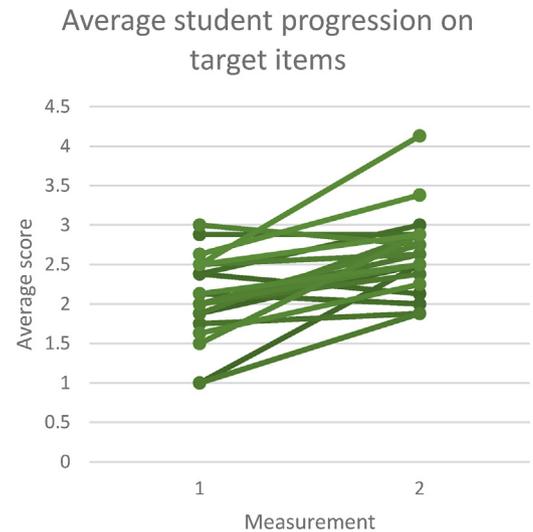
Fig. 1. Students' progression ($n = 21$) on the target items from pre-test (measurement 1) to post-test (measurement 2).
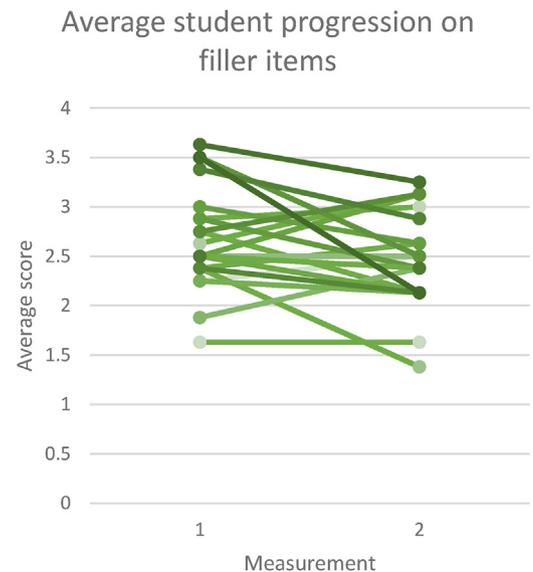
Fig. 2. Students' progression ($n = 21$) on the filler items from pre-test (measurement 1) to post-test (measurement 2).

progression on the target items cannot be attributed to a few extreme outliers: most of the students have progressed from measurement 1 to 2. From Fig. 2, which relates to filler items, it becomes apparent that the overall picture is far more diffuse.

Furthermore, students' reasonings showed a significant increase of explicit metaconcept use in the post-test ($t(117.49) = 4.65$, $p \leq .001$, $d = 0.70$), but a non-significant difference in implicit metaconcept use ($t(178) = 0.81$, $p = .42$). In terms of traditional concepts, there was no significant difference between the pre- and post-test for explicit occurrences ($t(178) = 1.24$, $p = .22$), nor was there a significant difference between implicit occurrences ($t(178) = 0.06$, $p = .95$). Independent *t*-tests also revealed no significant changes in the use of modern concepts, either explicitly ($t(172.74) = 1.74$, $p = .083$) or implicitly ($t(163.31) = 1.42$, $p = .167$). However, the intervention did have an effect on the amount of rules of thumb that students used, which decreased significantly ($t(150.48) = 2.72$, $p = .007$, $d = 0.42$). Finally, there were no significant changes in the use of linguistic manipulations ($t(178) = 0.42$, $p = .674$) or in the

Table 7
Frequencies of syntactic and semantic focus across the pre- and post-test (percentages in parentheses).

	Pre-test (%)	Post-test (%)	Total (%)
Syntactic focus			
No	68 (77.3)	40 (43.5)	108 (60.0)
Yes	20 (22.7)	52 (56.5)	72 (40.0)
Semantic focus			
No	36 (41.0)	60 (65.2)	96 (53.3)
Yes	52 (59.0)	32 (34.8)	84 (46.7)

application of inferences as a reasoning strategy ($t(178) = 0.27$, $p = .787$).

On a separate note, a chi-squared test was used to test the assumption that students focused more on form (syntax) in the post-test than in the pre-test, revealing a significant result ($\chi^2 (1) = 21.40$, $p = <.001$). Similarly, semantic focus diminished in the post-test ($\chi^2 (1) = 10.68$, $p = .001$). See Table 7.

The question is whether having a different focus is associated with different reasoning quality. Most analyses were characterized as having a clear focus on either syntax or semantics, but as mentioned in section 3.1, 24 analyses were characterized as not having a clear focus on either syntax or semantics. The averages of the three types of focus (syntactic: $M = 2.64$, $SD = 0.76$, semantic: $M = 2.39$, $SD = 0.69$; no focus: $M = 2.04$, $SD = 0.74$) suggest that quality might also depend on the type of focus a student reasoning has. To test this assumption, a One Way ANOVA was carried out, which indicated that the quality of reasoning indeed differs depending on the type of focus: $F(2,177) = 6.50$, $p = .002$. An additional Bonferroni post hoc analysis indicated that reasoning quality with no focus was significantly lower compared to reasonings with a syntactic focus ($p = .002$). There were no significant differences between the other types of focus. This indicates that tackling grammatical problems from a syntactic perspective is associated with better grammatical problem solving.

4. Discussion

4.1. Summary of study objectives

The present study pursued three objectives. First, it aimed to provide a deeper understanding of the characteristics of students' grammatical analyses in terms of their grammatical or linguistic (meta)concept use (declarative knowledge) and their linguistic reasoning (procedural knowledge). The second objective was to examine which of these characteristics are associated with good quality grammatical reasoning. The third objective, finally, was to determine whether an intervention that connected linguistic metaconcepts to traditional grammatical concepts, with an additional focus on linguistic manipulations, would lead to an increase in students' grammatical reasoning abilities. Each of these objectives is the topic of detailed discussion in Section 4.2, which synthesizes the main research findings.

4.2. Interpretation of main results

From the results it can be concluded that the undergraduate Dutch Language and Literature students generally don't analyze grammatical structures very well, averaging at a score of 2.44 on a five point Likert scale ($SD = 0.75$, $range = 1–4.5$). Given the total number of words they wrote in their reasonings ($M = 50.41$, $SD = 26.99$, $range = 14–143$), it seems they also struggle to reason about grammatical problems at length, even though they were encouraged to do so. Of course, analysis length cannot be directly related to reasoning quality, but the assignments from the pre- and post-test were specifically designed to elicit more elaborate

responses. The relatively low number of words might be explained by the fact that in traditional grammar teaching, no such lengthy reasoning is called for, and that therefore students are unfamiliar with elaborating on their analyses.

When students tackle grammatical problems, they make use of several types of concepts, the concepts from traditional grammar being the most frequent, in particular explicit ones. Hardly any implicit references to traditional grammatical concepts could be found in the data, suggesting that students are reasonably familiar with these concepts. This finding does not align well with other research, which found that students' explicit knowledge of traditional grammar is generally weak (e.g., Alderson & Hudson, 2013; Sangster et al., 2013). However, these studies rather showed how many concepts students were familiar with (i.e. passive knowledge). What the current study showed is how many times students explicitly referred to linguistic concepts (active knowledge). Moreover, the educational contexts in which these other studies have been carried out, differ from the Dutch context, making it difficult to directly compare their results to those from the current paper. With only their traditional grammar knowledge from secondary school as prior knowledge, it is perhaps unsurprising that before the intervention, students hardly used any metaconcepts or more modern concepts from linguistics, such as *agent*. In terms of their reasoning strategies, students predominantly use inferences (e.g., 'if an element is omissible, it is an adverbial'), although such statements sometimes lack nuance and relativity. Prior to the intervention, another frequently used strategy is the use of rules of thumb. This finding too can be easily accounted for, given students' exposure to a traditional form of grammar teaching, which is often characterized by its application of rules of thumb as an analyzing strategy. A noticeable difference in the characteristics of students' grammatical analyses pre- and post-test, was that in the pre-test, they focused more on meaning (semantics) and less on form (syntax) while in the post-test an opposite focus was found. This finding echoes the results of Watson and Newman (2017), who found that secondary school students who reflect on writing, typically have a preference for 'metasemantic talk', as opposed to more syntactic forms of metatalk. This result may indicate that students are more comfortable talking about meaning, because it comes more natural to them, and because it typically involves less grammatical terminology. Since after the intervention, the focus shifted towards syntax, it appears that attention to explicit grammatical form triggers a more syntactic focus in the students' analyses. This corresponds with Gombert's (1992) claim that metasyntactic understanding requires explicit teaching. Moreover, focusing on syntax is associated with higher quality in linguistic reasoning. This observation might be explained by the fact that form-related aspects of a reasoning (which are generally syntactic) are more concrete than intuitions on meaning (which is the case with analyses having a semantic focus). Most notably, linguistic experts seem to prefer having either a focus on syntax or semantics compared to having no focus at all. This finding can be explained by the fact that having a dominant focus is more likely to generate coherent argumentation, whereas having no clear focus increases the risk of incoherent argumentation. Future research is necessary to shed more light on this aspect of grammatical reasoning.

Across the board, both before and after the intervention, students were found to exhibit all kinds of implicit conceptual knowledge, although from the multiple regression analyses it has become clear that explicit knowledge types (both traditional and metaconcepts) predict grammatical analysis quality best, which again aligns with Gombert's (1992) views. One of the aims of grammar teaching should therefore be to make explicit the implicit knowledge that is already present with these students. We will return to this point in Section 4.4.

Other good predictors for the quality of students' grammatical analyses, apart from using explicit concepts from traditional grammar and explicit metaconcepts, are of a procedural nature: the application of linguistic manipulations and the use of inferences. However, even though linguistic manipulations were also covered in the intervention, students showed no significant increase in their application. This may be attributed to the fact that the interventions' focus was predominantly on making connections between linguistic metaconcepts and concepts from traditional grammar, and much less on how to reason like a linguist. However, given the significant decrease in the number of rules of thumb students used (which had no predicting value for grammatical analysis quality), the intervention did have an impact on the way in which students reason about grammatical problems, in their tendency to use superficial tricks. It is likely that developing a significant improvement in linguistic manipulation requires more learning time, or a different pedagogical approach. We will return to this point in section 4.4 as well.

The intervention was successful in improving the quality of students' reasoning on the target items, and it also managed to evoke significantly more metaconcepts. Given the results of the multiple regression, in which the use of metaconcepts was identified as a powerful predictor for the quality of grammatical reasoning, much of the progress in students' analyzing capabilities can arguably be attributed to their increased metaconcept use. Crucially, the increase in students' metaconcept use may seem like an obvious result given the nature of the intervention, but in fact, given the shortness of the intervention on the one hand and students' lengthy exposure to traditional grammar teaching in their school careers on the other (which encompasses only traditional concepts), it could also very well have been the case that students failed to incorporate metaconcepts into their reasoning. Moreover, the grammatical problems the students were asked to tackle, were not simply variants of grammatical problems they encountered in the intervention. Instead, these were problems of a type they had never encountered before, making it unpredictable whether they would find the use of metaconcepts helpful in their reasoning about these problems.

In short, the current study set out to gain empirical evidence for the theoretical argument that grammatical learning and instruction could strongly benefit from an approach that aims to make connections between linguistic metaconcepts and concepts from traditional grammar (Van Rijt & Coppen, 2017; Van Rijt et al., 2018). Given the strong predictive value of both these types of conceptual knowledge for good quality grammatical reasoning, it seems that this theoretical position can now be validated by empirical data.

4.3. Study limitations

Although the current study provides several relevant new insights in the area of grammatical or linguistic reasoning, in particular related to the role of linguistic metaconcepts, it is not without limitations. Arguably, the most important limitation derives from its exploratory nature, which led to a counterbalanced one group pre-test–post-test design. The significant progress between the pre- and post-test remains meaningful nonetheless, since the progress students made remains restricted to the target items, whereas their reasoning quality in the filler items remained constant. Moreover, the students' increase in reasoning ability and their increased metaconcept use revealed a moderate effect size (0.62 and 0.70, respectively), which is meaningful given the shortness of the intervention.

Follow-up research could nevertheless benefit from a more experimental design, involving a control group and a delayed post-test to measure long-term effects of the intervention. However, even without the intervention, much has become clear on the

characteristics of students' grammatical reasoning in terms of both declarative and procedural knowledge. What is more, the study provides important insights into the question of what characterizes good quality grammatical reasoning, which were derived from the multiple regressions.

Given its exploratory nature, the current study was unable to address the question whether there is a difference between the use of different metaconcepts related to different kinds of concepts from traditional grammar. More research on this topic is needed to gain a further understanding of these relationships.

Finally, since the current study was aimed at university students of Dutch Language and Literature, it is unclear to what extent the study's conclusions can be transposed to secondary education, where generally, most grammar education takes place. On the one hand, it might seem that the differences between secondary school students and first-year university students are paramount, and that therefore, such transposition is uncalled for. On the other hand, the Dutch university students in the current study have not received any training in grammar for at least three years,[3] which arguably puts them on par with third grade secondary school students in this regard. Their metacognitive abilities must have increased since the third grade, but their grammatical subject knowledge most likely has not. Perhaps it is even more likely that their subject knowledge has diminished over the years, which raises the question what exactly might be needed to incorporate the results of the current study into secondary school grammar teaching. We will return to this question in Section 4.4.

4.4. Implications for future research

Due to the exploratory nature of the current study, many questions on conceptual learning in grammar education still remain unanswered. We will address a couple of these issues that in our view are interesting for future research.

First, we argued that the target of grammar education should be to make explicit the implicit knowledge that students already possess. The question is how this can best be done, not only for university students, but also for secondary school students. There are good indications that stimulating discussion and inviting students to take different points of view on how to tackle a grammatical problem (multiperspectivity) can be used to this effect. This supports the assumptions of several scholars, such as Myhill and Jones (2015) and Ribas et al. (2014), who suggest that verbalization is likely to support metalinguistic understanding. A promising venue in this vein of thinking could be to embed grammar teaching in a sociocultural pedagogical setting, stimulating students to engage in exploratory talk (e.g., Mercer, 2000), which is known to be able to enhance students' historical reasoning in history classes (Havekes, 2015). Moreover, in L2 grammar education, contrary to L1 education, sociocultural approaches in grammar learning are quite familiar (e.g. Lantolf, Thorne, & Poehner, 2015). In future research, in particular for secondary education, the role of exploratory talk in enhancing grammatical understanding should be investigated. At the same time, it has to be taken into account that teachers' knowledge on grammatical concepts (e.g., Sangster et al., 2013) and metaconcepts (Van Rijt et al., 2019) is generally rather low, causing pedagogical difficulty in the implementation of such an approach. If grammar education is to benefit from implementing metaconcepts into school grammar, it is of great importance that teachers themselves have sufficient knowledge on such metaconcepts. On the one hand, this might mean that teachers need to master even more linguistic concepts than they already should, which puts more

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[3] In the Netherlands, grammar education typically stops after the third grade of secondary education (Van der Aalsvoort, 2016).

strain on teacher education programmes. On the other hand, this study has provided evidence for the benefits that can come from relating linguistic metaconcepts to traditional concepts. Therefore, even if it takes more time for teachers to master metaconcepts in addition to traditional ones, it can also provide them with a more in-depth understanding of the subject matter, hence strengthening their pedagogical repertoire, and potentially reducing any feelings of anxiety on grammar teaching (cf. Giovanelli, 2015). This could be especially important in educational contexts in which teachers generally lack metalinguistic knowledge (e.g. in the UK, cf. Giovanelli, 2015; Watson, 2012). Teaching linguistic metaconcepts can make understanding related traditional concepts easier for teachers in the long run. If teachers' grammatical insights can be enhanced via linguistic metaconcepts, they are also more likely to more effectively teach grammar in relation to writing (cf. Myhill et al., 2013).

Using exploratory talk as a design principle for grammatical learning could also prove valuable in learning how to reason more linguistically. The intervention of the current study was unable to generate more linguistic manipulations in students' grammatical analyses, which indicates that more pedagogical attention should go out to this procedural aspect of grammatical understanding. Engaging in exploratory talk could be particularly promising in this respect, since taking multiple perspectives invites students to consider different arguments to defend a particular grammatical analysis. Linguistic manipulations can be the input for such different arguments. Finally, since much of the recent literature on conceptual understanding relates to literacy development, it is recommendable that future research takes this perspective into account, exploring the role of linguistic metaconcepts in the development of writing (see Fontich, 2016; Mulder, 2010). In line with this, the role of linguistic metaconcepts in more contextualized approaches to grammar teaching (e.g. SFL) needs further exploring. Future research might examine how metaconceptual knowledge can positively affect students' written texts. For example, teaching *valency* might be helpful in helping students discover the communicative effects of leaving out an argument of the verb (e.g. 'Last night, the tiger killed again' as a newspaper headline to build up suspense, rather than 'Last night, the tiger killed *someone* again' – cf. De Swart, 2007). In previous quasi-experimental research, it has already been shown that first-year secondary school students are capable of understanding concepts such as *valency* (e.g. Van Rijt, 2013). More research should be done to gain a better understanding of which linguistic (meta)concepts might contribute to secondary school students' grammatical reasoning. Although the current study raises many questions for future research, it has uncovered some very interesting results, which have the potential to improve (L1) grammar education.

Conflict of interest

None declared.

Appendix 1. Short overview of the intervention

Note: Students were exposed to twelve hours of contact time, six hours in lecture time and six hours in seminar time. This led to six units, each comprised of one lecture and one seminar.

Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
Focus of the lecture					
Introduction to grammar: basic syntactic functions and parts of speech (character of the meeting: what do you recall from grammar at secondary school?)	Predication and instances of predication (predicative relationships at the primary level (verbal versus nominal predicates), at the secondary level (appositions) and at the tertiary level (adjective-noun relationships).	Valency and roles (both syntactic and semantic) that the main verb serves out (instances of *subcategorization* and *selection restriction*).	Complementation/ modification: recognizing complements and modifiers in sentences; word order differences associated with complement-adjunct word order (scrambling)	Traditional grammar: sentence types (subordinate versus coordinate clauses, etc.), basic word order principles	Integration of the knowledge from the previous units and repetition
Focus of the seminar					
Analysis of sentences, exploring the characteristics of word classes and parts of speech using basic linguistic manipulations (e.g. topicalization, paradigms, etc.)	Exploring structures from traditional grammar that can be understood through *predication*	Valency patterns in Dutch and other languages; constructions in which basic valency appears to have been overruled	Obligatoriness of complements; the theoretical difficulty of distinguishing between adjuncts and complements	Exploring regularities in Dutch word order related to sentence types, definiteness, etc.	Integration of the knowledge from the previous units and repetition

Appendix 2. Grammatical problems

Target items	Filler items

Argue why sentence 1 is remarkable in a grammatical sense, whereas sentence 2 is not:
 	
Jan regent. ('Jan rains')
Jan regent nat ('Jan rains wet')
	Below there are two sentences:
	
	  1. De vader van Jan fotografeert *hem*.
	    ('Jan's father photographs him')
	  2. Jan fotografeert *hem*.
	    (Jan photographs him')
	
	Explain why *hem* in (1) cannot refer to the father, but it can to *Jan*, whereas in *(2)*, *hem* can refer to *Jan*.

Argue what the grammatical function of *een rondje* ('a round') is in the following sentence:
 	
Jan heeft gisteren een rondje gelopen.
 	
('Jan has walked one round yesterday')
	Below there are two sentences:
	
	  1. Rinus zegt tegen Joop dat Wim *zichzelf* heeft gefotografeerd. ('Rinus tells Joop that Wim photographed himself')
	  2. Rinus zegt tegen Joop dat Wim *hem* heeft gefotografeerd. ('Rinus tells Joop that Wim photographed him').
	
	Explain why *zichzelf* in (1) can only refer to Wim, whereas *hem* in (2) could never refer to Wim.

Substantiate what the grammatical function of *erg lekker* ('very good') is in the following sentence: *De soep smaakt erg lekker* ('The soup tastes very good').	Explain whether it is best to use a singular or a plural finite form of the finite verb in sentences of the type: *Dit soort dieren is/zijn uitgestorven.* ('This type of animal is/are extinct')
Explain why the sentence *Jan loopt zijn schoenen stuk* ('Jan walks his shoes damaged') can be considered grammatical, whereas the sentence *Jan loopt zijn schoenen* ('Jan walks his shoes') cannot.	Explain whether it would be best to use a singular or a plural form of the finite verb in sentences of the type: *Een aantal mensen kwam/kwamen te laat.* *A number people come/came too late* ('A number of people arrives/arrive too late')

Note: (Literal) Translations from Dutch by the authors. In all cases, students were explicitly encouraged to be as elaborate as they could be in their analyses.

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