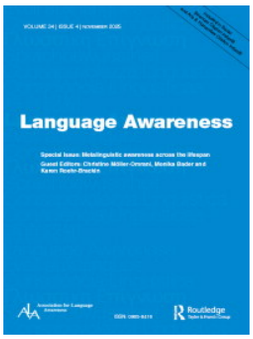

Language Awareness

ISSN: 0965-8416 (Print) 1747-7565 (Online) Journal homepage: www.tandfonline.com/journals/rmla20

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To cite this article: Karen Roehr-Brackin, Karolina Baranowska, Renato Pavlekovic & Paweł Scheffler (2025) Inductive instruction at beginner level: the contribution of metalinguistic awareness at the earliest stages of adult L2 learning, Language Awareness, 34:4, 886-908, DOI: 10.1080/09658416.2025.2576075

To link to this article: https://doi.org/10.1080/09658416.2025.2576075

Published online: 23 Oct 2025.

LANGUAGE AWARENESS
2025, VOL. 34, NO. 4, 886–908
https://doi.org/10.1080/09658416.2025.2576075

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Inductive instruction at beginner level: the contribution of metalinguistic awareness at the earliest stages of adult L2 learning

Karen Roehr-Brackin[a], Karolina Baranowska[b], Renato Pavlekovic[a] and Paweł Scheffler[b]

[a]Department of Language and Linguistics, University of Essex, Colchester, UK; [b]Faculty of English, Adam Mickiewicz University, Poznań, Poland

ABSTRACT

While there is evidence for an association between metalinguistic awareness (MLA) and second language (L2) achievement, no study has investigated the facilitative potential of MLA in an inductive instructional approach that encourages learners to focus on form to arrive at metalinguistic generalisations. We developed a short suite of online lessons in beginners' Polish targeting two morphological features. International volunteers ($N = 108$) aged 18–62 with differing levels of language learning experience and language-analytic ability participated in inductive lessons and subsequent attainment tests; a sub-sample ($N = 27$) provided qualitative data by articulating their understanding of the target features and their perceptions of the learning materials. Our results confirm a positive relationship between metalinguistic awareness and L2 attainment. At the same time, participants' metalinguistic awareness was relatively low in both quantitative and qualitative terms, pointing towards the challenge of an inductive approach at beginner level when relatively little input is available. Differences in hypothesised learning difficulty between the two target features were reflected in learners' self-reported ability to identify the underlying patterns, but not in their L2 attainment or metalinguistic descriptions. We argue that a quantitative step change from a smaller to a larger number of inflections may have led to a boost in MLA.

Chociaż istnieją dowody na związek między świadomością metajęzykową (MLA) a osiągnięciami w nauce języka drugiego (L2), żadne badanie nie zbadało potencjału, jaki niesie MLA w indukcyjnym podejściu dydaktycznym, które zachęca uczniów do skupienia się na formie w celu dojścia do uogólnień metajęzykowych. Opracowaliśmy krótki zestaw lekcji online dla początkujących z języka polskiego, koncentrujących się na dwóch cechach morfologicznych. W lekcjach indukcyjnych i późniejszych testach osiągnięć uczestniczyli międzynarodowi ochotnicy ($N = 108$) w wieku 18–62 lat, o zróżnicowanym doświadczeniu w nauce języków oraz zdolnościach analityczno-językowych; podgrupa ($N = 27$) dostarczyła danych jakościowych, wyjaśniając swoje rozumienie

ARTICLE HISTORY
Received 9 June 2025
Accepted 3 October 2025

KEYWORDS
Metalinguistic awareness; adult second language learning; inductive instruction; learning difficulty; learner self-report

CONTACT Karen Roehr-Brackin kroehr@essex.ac.uk Department of Language and Linguistics, University of Essex, Colchester, UK

wybranych cech oraz postrzeganie materiałów dydaktycznych. Nasze wyniki potwierdzają pozytywną zależność między świadomością metajęzykową a osiągnięciami w L2. Jednocześnie świadomość metajęzykowa uczestników okazała się stosunkowo niska zarówno w wymiarze ilościowym, jak i jakościowym, co wskazuje na wyzwania związane ze stosowaniem podejścia indukcyjnego na poziomie początkującym, gdy dostępnych jest stosunkowo niewiele danych językowych. Różnice w zakładanym stopniu trudności nauki między dwiema cechami morfologicznymi zostały odzwierciedlone w subiektywnie deklarowanej przez uczniów zdolności do rozpoznania leżących u podstaw wzorców, ale nie w ich wynikach w L2 ani w opisach metajęzykowych. Twierdzimy, że ilościowa zmiana skokowa – od mniejszej do większej liczby form fleksyjnych – mogła prowadzić do wzrostu świadomości metajęzykowej.

PLAIN LANGUAGE SUMMARY

Research has shown that learners who are aware of how language works—what is often called *metalinguistic awareness*—tend to do better when learning a new language in classroom settings. Metalinguistic awareness involves noticing, thinking about, and being able to explain language patterns, and appears to support successful language learning. This study explored the role of metalinguistic awareness in adult beginners learning Polish, a language completely unfamiliar to them. The focus was on *inductive instruction*, an approach where learners are given examples and are encouraged to work out patterns rather than being taught grammar rules directly (*deductive instruction*). The goal was to find out whether learners could identify and describe grammar features on their own and how this was related to their learning success as well as individual characteristics such as previous language learning experience and language-analytic ability. Participants completed four online lessons introducing two Polish grammar points, followed by tests and a questionnaire. Many learners found it difficult to articulate accurate grammar rules, although those who were better able to do this also did better on the tests measuring learning success. Interestingly, learning success was the same on the more and less complex grammar features. Moreover, the more complex feature seemed to prompt better awareness than the simpler one, suggesting that increased difficulty that is 'more of the same' does not pose an additional analytic challenge and may actually boost the development of metalinguistic awareness.

Introduction

Research to date has provided evidence for the potentially facilitative role of metalinguistic awareness in instructed second language (L2) learning, suggesting that the development of metalinguistic understanding, on the one hand, and the attainment of L2 proficiency, on the other hand, are connected (for reviews, see Roehr-Brackin, 2018; Simard & Gutiérrez, 2018). While instructional approaches differ both across and within educational settings, it is still the case that learners typically acquire metalinguistic knowledge from teacher explanations and from instructional materials such as textbooks, reference grammars, and form-focused exercises encountered in class or during independent study, for example, *via* language learning apps.

The present study focuses on the development and role of metalinguistic awareness in the context of an inductive instructional approach which encourages learners to focus on form, but does not offer an explicit description or explanation of the L2 target(s). In a short

suite of beginner-level online learning materials, we provided presentation and controlled practice activities on two morphological features of Polish. We investigated whether and to what extent our adult participants developed any metalinguistic awareness of the target structures, and we examined the relationship of learners' metalinguistic awareness with learning outcomes and selected individual difference variables. Thus, the present paper offers insights into the role of metalinguistic awareness in explicit inductive instruction at the earliest stages of learning a new L2.

Theoretical and empirical background

The notion of metalinguistic awareness

Before discussing the role of metalinguistic awareness in the context of instructed L2 learning, it is important to define the concept. The research literature features a range of related terms, such as 'metalinguistic awareness', 'metalinguistic knowledge', 'metalinguistic performance', 'metalinguistic activity' and 'metalinguistic ability', among others. Construct definitions differ slightly while also showing considerable overlap (for a detailed discussion, see Simard & Gutiérrez, 2018). For instance, metalinguistic ability is observable in metalinguistic performance involving 'any objectification of language' for the purpose of reflection or analysis (Birdsong, 1989, p. 1). It is characterised by attention to language form rather than linguistic content, or put differently, by looking *at* language rather than through it to the intended meaning (Cummins, 1987). Metalinguistic knowledge refers to an individual's knowledge about language and is seen as part of a person's explicit (or conscious) knowledge (Ellis, 2004). Explicit knowledge and learning draw on a learner's metalinguistic awareness, which comprises awareness of the nature, function, and form of language (Baker, 2006).

As argued elsewhere (Roehr-Brackin, 2025), attempts to differentiate between the various notions at a theoretical level do not easily translate into practice, in the sense that they are not necessarily reflected in operationalisations of the construct(s). With this in mind, we use the term 'metalinguistic awareness' throughout the present paper. For the purpose of our study, we defined metalinguistic awareness as learners' capacity to treat language as an object of reflection and analysis and to arrive at verbalisable knowledge about the targeted linguistic features.

Metalinguistic awareness at the interface of cognition and metacognition

Metalinguistic awareness has been shown to be related to both cognitive and metacognitive variables, with language-analytic ability the most prominent cognitive correlate and learner beliefs an important metacognitive correlate. In the following, we briefly discuss each of these variables.

Learner beliefs can be defined as 'conceptions, ideas and opinions learners have about L2 learning and teaching and language itself' (Kalaja et al., 2018, p. 301). Accordingly, beliefs have been investigated from a range of perspectives. The classic cognitive approach views beliefs as a relatively stable subset of an individual's metacognitive knowledge (Wenden, 1998, 1999). Some recent work has approached beliefs from a qualitative perspective *via* discursive or dialogic methods, which focus on learner agency and identities, for instance. Such research has attempted to capture the dynamicity assumed by sociocultural and

complex dynamic systems theoretic views of language and language learning (Kalaja et al., 2018).

In the context of instructed L2 learning, research taking a classic approach has investigated learners' beliefs about the benefits or otherwise of explicit grammar instruction and corrective feedback (Loewen et al., 2009; Schulz, 2001) as well as the perceived learning difficulty of specific grammatical structures and the perceived usefulness of instruction on such structures (Scheffler, 2008; Thepseenu & Roehr, 2013). At the most general level, adult learners from different L1 and cultural backgrounds learning a variety of L2s regard explicit instruction and error correction as necessary and beneficial while also appreciating the limitations of metalinguistic awareness, for example, in contexts requiring oral communication.

An investigation of learners' metalinguistic awareness and their beliefs which drew on both quantitative and qualitative methods (Thepseenu & Roehr, 2013) revealed convergence between participants' actual metalinguistic awareness and their perceptions of learning difficulty. Moreover, learners' belief systems were found to be complex constructs, in the sense that what appeared to be contradictory views at first glance were in fact quite differentiated perceptions revealing both the benefits and limitations of metalinguistic awareness in the context of L2 learning and, above all, L2 use (Thepseenu & Roehr, 2013). In summary, an association between beliefs and perceptions (as facets of metacognition) and metalinguistic awareness is in evidence.

At the cognitive level, language-analytic ability is a close correlate of metalinguistic awareness. The concept of language-analytic ability refers to the ability to infer linguistic rules and make linguistic generalisations; it is conventionally considered a component of language learning aptitude (Skehan, 1998, 2002). Alongside phonetic coding ability and associative memory, it is part of what current theorising categorises as aptitude for explicit learning (Li, 2022; Li & DeKeyser, 2021), which has been shown to be of particular importance at early stages of L2 learning (Artieda & Muñoz, 2016; Pavlekovic & Roehr-Brackin, under review).

Importantly for our present focus, language-analytic ability shows overlap with metalinguistic awareness as defined above. Both concepts are concerned with the learner's capacity to reflect on language, to treat it as an object of analysis, and to (try to) identify patterns and systematicities. However, according to our definition as stated above, metalinguistic awareness is a broader construct than language-analytic ability: in addition to subsuming language-analytic ability, it includes the construction of verbalisable knowledge about any given linguistic target(s).

In terms of measurement, language-analytic ability is typically assessed by means of aptitude tests drawing on L1 or invented (mini-)languages, whereas metalinguistic awareness tests often—though certainly not always—focus on L2 (for examples of measures, see Roehr-Brackin, 2018; Simard & Gutiérrez, 2018). Nevertheless, language-analytic ability and metalinguistic awareness are two sides of the same coin (Ranta, 2002) that have been found to be positively correlated in both children (Roehr-Brackin & Tellier, 2019) and adults (Roehr & Gánem-Gutiérrez, 2009).

The role of metalinguistic awareness in instructed adult L2 learning

The research literature offers evidence for a positive association between metalinguistic awareness and cognitively mature learners' L2 achievement in instructed settings (e.g. Absi, 2014; Alderson et al., 1997; Elder & Manwaring, 2004; Gutiérrez, 2016; Renou, 2000; Roehr,

2008), especially—though not exclusively—if outcome measures focus on grammar, reading and writing skills (for a concise review, see Simard & Gutiérrez, 2018). Whereas cross-sectional correlational research designs cannot disentangle cause and effect, it is plausible to argue that the relationship between metalinguistic awareness and L2 outcomes is likely bidirectional, with the two variables mutually reinforcing each other (for a detailed discussion, see Roehr-Brackin, 2018). In keeping with this line of argument, previous research offers evidence for an association between learner awareness in the sense of noticing and/or metalinguistic understanding and improved L2 performance, with higher levels of awareness generally more advantageous (Camps, 2003; Leow, 2000; Rosa & O'Neill, 1999).

Studies with an experimental or quasi-experimental design have typically compared explicit form-focused instruction with implicit meaning-focused instruction to identify differential effects on learners' L2 attainment. An instructional treatment can be considered explicit 'if rule explanation comprised any part of the instruction (…) or if learners were directly asked to attend to particular forms and to try to arrive at metalinguistic generalizations of their own' (Norris & Ortega, 2001, p. 167). Explicit instruction fosters—but does not guarantee—explicit learning. Both explicit instruction and explicit learning draw on and (aim to) develop explicit knowledge, that is, knowledge that is accessible to conscious awareness (for a detailed discussion of explicit instruction, learning, and knowledge, see Ellis et al., 2009).

The cumulative findings reported in two meta-analyses which captured results from a total of 72 individual studies conducted over more than 30 years are unequivocal: explicit instruction is more effective than implicit instruction when specific L2 features are targeted (Goo et al., 2015; Norris & Ortega, 2001). In this context, it is worth noting that only a minority of studies included delayed post-tests and that longitudinal research is likewise in short supply. Nevertheless, findings from the few longitudinal studies that exist point in the same direction, that is, explicit form-focused instruction is effective with adult L2 learners (e.g. Klapper & Rees, 2003; Macaro & Masterman, 2006). A caveat is in order, however, since without exception, the studies in question were conducted with fully literate and educated learners who were either in compulsory secondary or optional tertiary-level (i.e. university-level) education.

Learners in such educational settings have typically experienced at least some form-focused instruction. Often, this type of instruction follows the classic presentation-practice-production (PPP) paradigm, where a systematic pattern underlying an L2 feature or a pedagogical grammar rule is presented explicitly. This is followed by controlled practice at the sentence level and subsequently by free production practice in the context of more meaning-focused activities such as oral role-plays or discourse-level writing in a particular genre. The PPP paradigm often takes a deductive approach, as captured in the first part of the definition of explicit instruction given above (rule explanation is provided). This can be contrasted with an inductive approach, as captured in the second part of the definition given above (learners are asked to attend to forms or arrive at metalinguistic generalisations on their own).

Research investigating so-called aptitude-treatment interactions is aimed at identifying the best fit between learners' individual characteristics (aptitude) and the characteristics of specific instructional approaches (treatment). Even though findings to date rely on a wide range of operationalisations of both aptitude and treatment and are thus somewhat difficult to compare, a common thread is emerging with regard to deductive instruction. An explicit deductive approach which provides learners with a metalinguistic description of the targeted L2 feature appears to level the playing field, in the sense that it seems to

be equally suitable for all (literate, educated) learners, regardless of individual differences in cognitive ability (Erlam, 2005; Hwu et al., 2014; Hwu & Sun, 2012; Li et al., 2019; Roehr-Brackin et al., 2024; Sanz et al., 2016). Therefore, it is not surprising that many studies comparing a deductive with an inductive approach have found the former to be more advantageous, although opposing findings have also been reported (Herron & Tomasello, 1992).

It is worth noting that the two instructional approaches have been operationalised in various ways in existing studies. Inductive instruction in particular has been translated into a range of instructional sequences or steps, with learners receiving varying levels of guidance. For instance, learners may be encouraged to formulate a metalinguistic description of the targeted feature(s) by themselves (Moranski & Zalbidea, 2022), or they may be presented with metalinguistic information formulated by the teacher or researcher at the end of the learning sequence (Hwu et al., 2014; Hwu & Sun, 2012). Alternatively, metalinguistic descriptions of the targeted feature(s) may be avoided altogether, and instead, learners are encouraged to focus on form in the context of production practice (Herron & Tomasello, 1992) or error identification tasks (Erlam, 2005).

Regardless of specific operationalisations, it can be argued that inductive instruction is more demanding than deductive instruction. By way of explanation for the potentially levelling effect of deductive instruction in mixed-ability settings, it has been suggested that the metalinguistic scaffolding which is provided as part of a deductive approach can compensate for weaknesses in language-analytic ability in particular, thus neutralising the impact of individual differences and allowing all learners to succeed. Indeed, a recent study indicates that the levelling effect of deductive instruction is not restricted to the classic PPP paradigm with propositional pedagogical grammar rules which are typically presented one at a time or step by step, but also extends to the less familiar approach of concept-based instruction which explicitly presents a grammatical concept in its entirety (Roehr-Brackin et al., 2021). It is worth noting, however, that the study in question worked with experienced L2 learners at tertiary level who had had extensive exposure to form-focused instruction in the course of their language learning careers. Therefore, language learning experience is another variable which may interact with participants' metalinguistic awareness and its role in L2 achievement.

Research issues and questions

In summary, existing research has yielded evidence for a positive association between metalinguistic awareness and L2 attainment in literate, educated learners in instructed settings. Moreover, metalinguistic awareness has been shown to be correlated with both cognitive and metacognitive variables, the most prominent of which are learners' beliefs or perceptions and language-analytic ability. Studies investigating aptitude-treatment interactions suggest that deductive instruction which provides learners with ready-made metalinguistic descriptions and explanations may level the playing field by compensating for weaknesses in language-analytic ability. The question arises as to the role of metalinguistic awareness in the context of explicit inductive instruction as defined above (Norris & Ortega, 2001), that is, an approach which encourages learners to be proactive and therefore potentially engage in greater depth with both the instructional materials in general and certain aspects of the L2 more specifically. We addressed this issue in the context of a quasi-experimental study with

adult participants learning the beginnings of L2 Polish—a language they were completely unfamiliar with. We posed the following research questions:

RQ1a: Do participants develop and articulate metalinguistic awareness about the structures targeted in the context of inductive instruction?
RQ1b: What is the nature of participants' metalinguistic awareness?
RQ2: Is participants' reported metalinguistic awareness related to
(a) post-test performance,
(b) prior language learning experience,
(c) language-analytic ability, and
(d) perceptions of the instructional materials?

Methodology

We conducted a quasi-experimental study during which adult volunteers were exposed to four online language lessons in beginners' Polish targeting two morphological features. This was followed by two immediate post-tests, a range of individual difference measures, and an exit questionnaire which included open-ended questions on participants' metalinguistic awareness of the targeted L2 structures. In the subsequent paragraphs, we provide full details on the experimental treatment, the instruments used, the participant sample, and our approach to data analysis.

Experimental treatment and targeted L2 structures

The experimental treatment was aimed at complete beginners and was developed to introduce and subsequently test two frequent morphological features of Polish, that is, adjective-noun gender agreement and the genitive of negation, as shown in Table 1.

We hypothesised that adjective-noun gender agreement with three inflections would be less difficult for participants than the genitive of negation with six inflections whose forms partly overlap with the previously introduced endings. This opacity of mapping was expected to present a greater challenge (e.g. *-a* not only designates feminine in the nominative but also neuter in the genitive).

The four language lessons comprised presentation and controlled practice and were receptive in nature. The practice exercises made use of four-way multiple-choice items

Table 1. Targeted L2 features.

Lessons 1 + 2	**Adjective-noun gender agreement**
	czerwona walizka (feminine, nominative)
	red suitcase
	czerwony zeszyt (masculine, nominative)
	red notebook
	czerwone krzesło (neuter, nominative)
	red chair
Lessons 3 + 4	**Genitive of negation**
	Kupiłam walizkę (feminine, accusative) → Nie kupiłam walizki (feminine, genitive)
	I bought a suitcase → I didn't buy a suitcase
	Kupiłam zeszyt (masculine, accusative) → Nie kupiłam zeszytu (masculine, genitive)
	I bought a notebook → I didn't buy a notebook
	Kupiłam krzesło (neuter, accusative) → Nie kupiłam krzesła (neuter, genitive)
	I bought a chair → I didn't buy a chair

that could be attempted repeatedly; accuracy feedback was provided. Each lesson had a time limit, so overall exposure to the input was controlled, but within the limit of each lesson, participants could move freely through the materials. We aimed for ecological validity, with the lessons designed to reflect real-life language learning materials that might be encountered in face-to-face classes or on language learning apps. The lessons were based around a storyline of a couple moving house (Lesson 1), going shopping (Lesson 2), organising a housewarming party (Lesson 3), and going on a business trip (Lesson 4).

We developed four matched treatment conditions drawing on different input modalities and types of explicit instruction. Three conditions used an inductive approach and one a deductive approach, resulting in the following distribution: auditory inductive (100% auditory input), written inductive (100% written input), mixed inductive (50% auditory and 50% written input), and mixed deductive (50% auditory and 50% written input). In the deductive condition, participants were provided with metalinguistic descriptions of the targeted L2 features. In the inductive conditions, participants were prompted to attend to the endings of words, that is, we encouraged a focus on form, but participants had to arrive at any metalinguistic generalisations on their own. The inductive conditions included additional controlled practice exercises (5 each for Lessons 1 and 2, 10 each for Lessons 3 and 4) to ensure exposure to a sufficiently large number of tokens for the underlying inflectional patterns to be identified. Example lesson materials are shown in Figure 1.

The language lessons were preceded by two vocabulary learning sessions during which the words and expressions featuring in the lessons were presented in bilingual Polish-English pairs. Pictorial support was provided whenever possible to aid memorisation. The vocabulary was presented bimodally in both written and auditory format. The vocabulary learning sessions had an overall time limit, but participants could move freely through the materials. Each vocabulary learning session was followed by a vocabulary test in four-way multiple-choice format which participants had to pass with a minimum of 90% accuracy to proceed to the language lessons.

Outcome and individual difference measures

Participants' learning of the targeted features was assessed by means of two four-way multiple-choice tests that used the same format as the practice exercises in the lessons and were matched to the respective input modality learners had experienced (auditory, written, or mixed). Post-test 1 ($k = 15$) was completed after Lessons 1 and 2 and focused on adjective-noun gender agreement; post-test 2 ($k = 25$) was administered after Lessons 3 and 4 and focused on the genitive of negation.

After the instructional treatment, participants took part in an operation span task (Unsworth et al., 2005), which was aimed at assessing their executive working memory (Juffs & Harrington, 2011; Li, 2023; Linck et al., 2014; Wen et al., 2021). They then completed the LLAMA aptitude test suite (Meara, 2005; Meara & Rogers, 2019), which comprises subtests of associative memory (LLAMA B), phonetic coding ability (LLAMA D and E), and language-analytic ability (LLAMA F). Furthermore, we administered a probabilistic serial reaction time task (Kaufman et al., 2010) to measure implicit sequence learning ability (Granena, 2020).

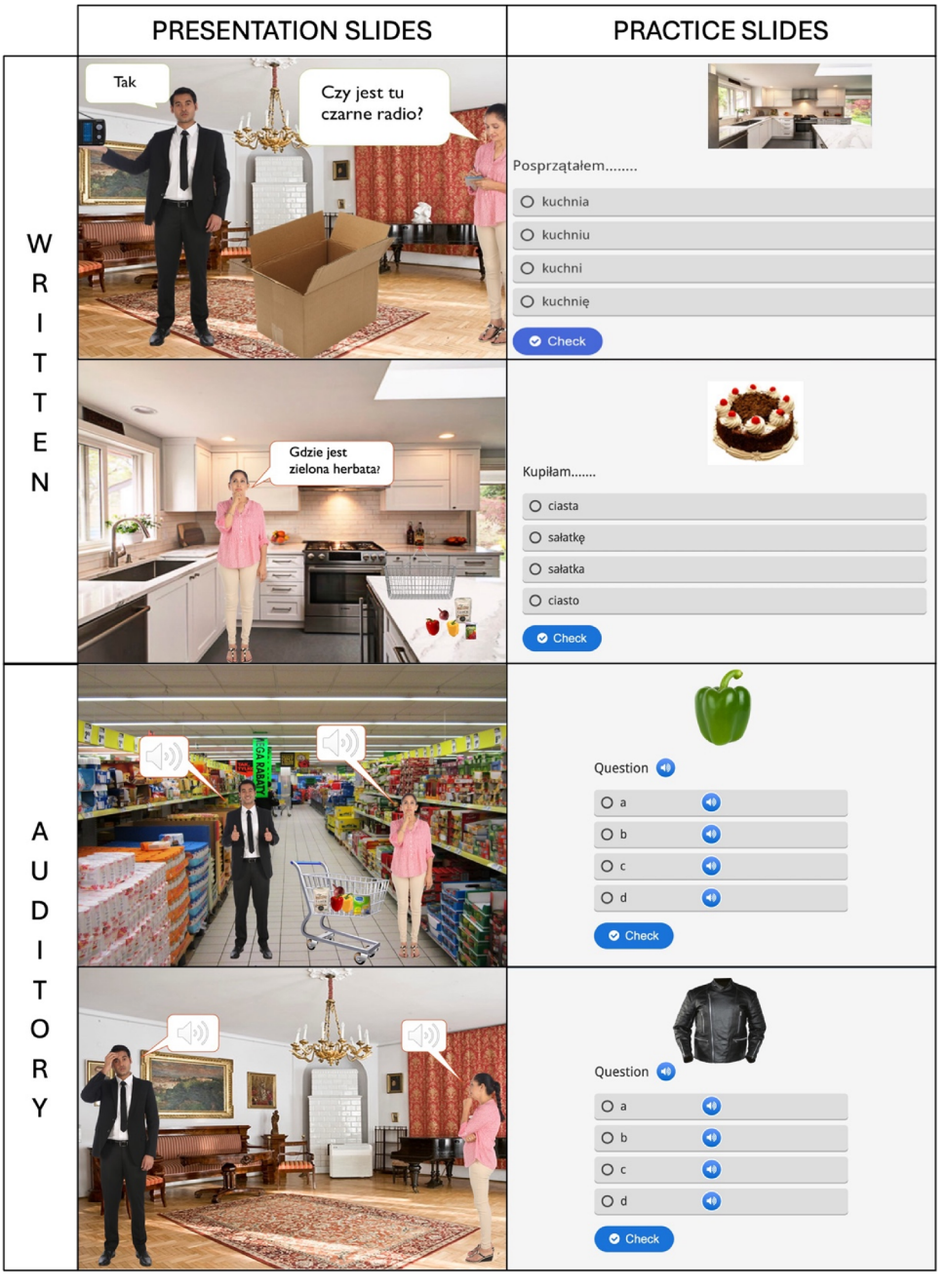

Figure 1. Example lesson materials.

As a final step, participants filled in an exit questionnaire which gathered demographic information, including prior language learning experience in terms of the number of previously learned languages and self-reported proficiency in each of these languages. In our operationalisation of beliefs, we asked the volunteers about their perceptions of the instructional materials by inviting them to complete twelve Likert-scale items pertaining to

navigation of the online materials, the time available for vocabulary learning and for working through the language lessons, and the quality of lesson materials in terms of the challenges they posed, their entertainment value and the interest they generated. In addition, we asked about motivation, enjoyment, and anxiety in relation to the instructional sequence. Participants were then invited to rank-order input modalities (auditory, written, mixed) in terms of preference and had the option to report in an open-ended format what they liked and what they disliked about the instructional materials.

Last but not least, participants in the inductive treatment conditions were asked whether they thought they had worked out the grammar rules featuring in the two sets of lessons. If they responded with 'no' or 'not sure', there was no further follow-up;[1] learners who responded 'yes' were invited to spell out the systematicities underlying the target features, according to their understanding. Thus, in accordance with our definition of the construct, metalinguistic awareness was operationalised as participants' ability to develop and articulate knowledge about the morphological features targeted in the instructional materials.

The experimental procedure is summarised in Table 2. Participants were instructed to complete the three components of the study within the same week to avoid undue forgetting. This could but did not have to be done on consecutive days, as long as completion within a 7-day period was achieved. As all materials were online, participants worked through the study on their own laptop or desktop computers at times that were convenient to them. They were guided through the study components automatically; in the event of any technical issues or questions, they could contact one of the researchers for assistance.

The study was approved by the University of Essex Ethics Sub-Committee 3 before participant recruitment began (reference ETH2324-0056).

Participants

A total of 136 volunteers aged 18–62 (mean = 22.86, *SD* = 6.86) completed the study. Participants came from a wide range of L1 backgrounds, with 14 different L1s and 7 bi- or multilingual L1 combinations represented. The most frequently reported L1s were Chinese (*N* = 91), Japanese (15), and Turkish (6). Proficiency in English (whether as L1 or L2) and no knowledge of Polish or other Slavic languages were criteria for participation.

Table 2. Experimental procedure.

Day 1	
30 mins	Vocabulary learning
5 mins	Vocabulary Test 1—proceed if passed; go back to start if failed
35 mins	Lesson 1
25 mins	Lesson 2
10 mins	Post-test 1 (adjective–noun gender agreement)
Day 2	
40 mins	Vocabulary learning
5 mins	Vocabulary Test 2—proceed if passed; go back to start if failed
45 mins	Lesson 3
35 mins	Lesson 4
15 mins	Post-test 2 (genitive of negation)
Day 3	
10 mins	Operation span task
30 mins	LLAMA aptitude test suite
30 mins	Serial reaction time task
15 mins	Exit questionnaire

The results reported in this paper are based on data from participants in the inductive treatment conditions ($N = 108$). A subsample of 27 participants provided qualitative data by responding to the open-ended questionnaire items asking about their metalinguistic awareness of the targeted L2 features. Accordingly, the number of participants included in subsequent analyses varies, so *N* is stated throughout.

Data analysis

In order to address RQ1a, we calculated descriptive statistics and ran inferential comparisons between groups of participants who responded 'yes', 'no', or 'not sure' to the question as to whether they thought they had worked out the targeted morphological rules. To address RQ1b, we scored participants' open-ended metalinguistic verbalisations by focusing on the key notions required to accurately explain the systematicities underlying the targeted morphological features, as summarised in Table 3. Example responses and the scores associated with them are provided in Table 4. The first author's coding was verified independently by the second author who re-coded all responses. Inter-coder agreement was 100%.

Table 3. Scoring scheme for metalinguistic descriptions.

Lessons 1 + 2: Adjective-noun gender agreement	**Score**
Mentions gender and/or endings	1
Mentions adjectives/nouns	1
Maximum possible	2
Lessons 3 + 4: Genitive of negation	
Mentions gender and/or endings	1
Mentions case	1
Mentions negation	1
Maximum possible	3

Table 4. Example metalinguistic descriptions and associated scores.

Adjective-noun gender agreement	**Score**
I can't remember much grammar about the first lesson, but I know there were directional concepts.	0
There are four final word formats in Polish. I and we corresponds to am. You and your corresponds to sz.	0
Endings of the colours depend on the words for example the colour 'zolty' becomes zolta paprika.	1
There are male and female words. Usually a word ends with 'a' is female.	1
There are different ways to spell adjectives depending on the ending of the noun. If the noun ends in -a, so does usually the adjective, if it ends in a consonant, it ends with -y, I believe.	2
Inflection of adjectives depending on the genders of the following nouns.	2
Genitive of negation	
Endings of the colours depend on the words.	0
Past tense and the last letter after different verb.	0
In my view, nouns will deform in the negative form, but I do not understand that when exactly does it end in 'a' and when does it end in 'u'.	1
I have noticed the influence of tense in Polish words and sentences, where the verbs and the spelling of the objects changed by the influence of tense/genders, for instance—'kupialas salatke meaning did you buy salat?' on the other hand, 'nie kupiam salatki means no I didn't buy salat'. Here, the spelling of the object changed from salatke to salatki.	1
I believe the ending of the adjective and noun change in negative sentences, as well as with certain verbs like to take and to buy.	2
The end of a word changes whether the sentence is positive or negative. Words end with consonant such as 't', 'n' add 'u' at the end if it is negative. For example, a tie in Polish is 'krawat'. So you can say 'I have a krawat'. But in a negative sentence, you can say 'I don't have a krawatu'. While words end with 'o' change to 'a' if it is negative. For example, 'radio' is 'radio' in a positive sentence, 'I have a radio'. But it changes to 'radia' in a negative sentence, such as 'I don't have a radia'. Words end with an unique symbol similar to 'e' turns to 'ski' in negative. Such as, 'I have a salade'. to 'I don't have a saladski'. However, the word cat seems like an exception. It was both 'kota' regardless of the sentence is positive or negative. Probably the words describe animal do not change.	2
Declension of nouns (accusative case: differences between affirmative and negative sentences are based on grammatical genders).	3

In order to address RQ2, we ran correlational analyses drawing on post-test and LLAMA F (language-analytic ability) scores. Prior language learning experience was quantified by means of a multilingualism score, which was the sum of each participant's z-scores for the reported number of previously encountered languages and the reported mean level of proficiency achieved in these languages. Perceptions of the instructional materials was investigated both quantitatively and qualitatively. A score was derived from the twelve closed-ended questionnaire items pertaining to participants' perceptions, with higher scores indicating more positive perceptions. In addition, we performed a thematic content analysis of the open-ended responses to questionnaire items asking about likes and dislikes of the instructional materials.[2]

Results and discussion

RQ1a: Do participants develop and articulate metalinguistic awareness about the structures targeted in the context of inductive instruction?

A total of 85 participants responded to the question of whether they thought they had worked out the systematicities underlying the targeted L2 features. Figure 2 shows an overview of the distribution of responses.

It is quite clear from the results in Figure 2 that only a minority of participants believed that they had inferred the targeted patterns ($N = 31$ or 37% for adjective-noun gender agreement, $N = 21$ or 25% for the genitive of negation; a total of 16 participants believed they had worked out the pattern for both targets). The distribution of responses is broadly in line with expectations regarding the hypothesised learning difficulty of the two targeted features, given that the number of 'yes' answers decreases and the number of 'no' and 'not sure' answers increases between Lessons 1 and 2 (adjective-noun gender agreement) on the one hand and Lessons 3 and 4 (genitive of negation) on the other hand.

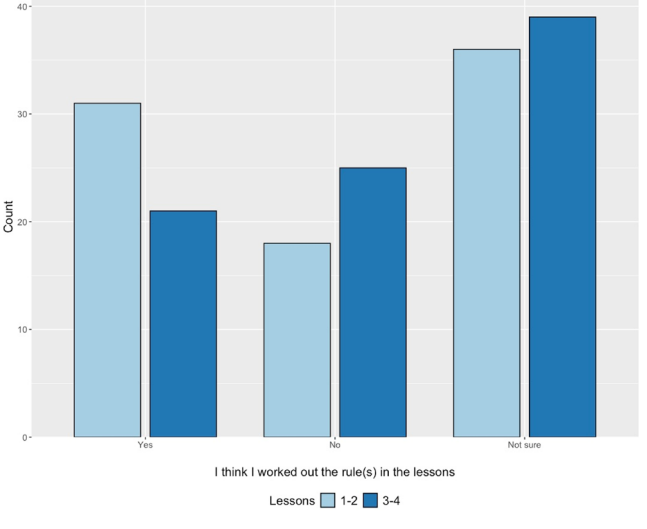

Figure 2. Participants' self-reported ability to infer the targeted grammar rules (count = no. of participants).

Figure 3 shows the post-test scores achieved by participants who thought they had worked out the targeted grammar rules, those who did not think so, and those who were not sure.

The results in Figure 3 indicate that participants' actual performance is descriptively in line with their self-assessment in that the 'yes' group does best on both post-tests. The differences in scores between the 'yes', 'no', and 'not sure' groups are not statistically significant for post-test 1 (Kruskal-Wallis $p = .160$). The difference between the 'yes' and 'not sure' groups is statistically significant for post-test 2 (Kruskal-Wallis $p = .007$), but the difference between the 'yes' and 'no' groups is not (Kruskal-Wallis $p = .130$).

Moreover, it is worth noting that post-test medians are clearly above 25%, indicating above-chance performance in all three groups. This suggests a learning effect regardless of whether participants thought they had inferred the systematicities underlying the targeted features, which in turn points towards two possibilities that are not mutually exclusive: learners may have begun to abstract (some) implicit knowledge of the targets and/or they had actually inferred the pattern explicitly but did not report this accurately, either because they were too uncertain about their knowledge or because they chose not to report it. To some extent, the former reason is reflected directly in the 'not sure' responses, whereas the latter reason may apply to Lessons 3 and 4 in particular, since at that point participants knew that a 'yes' answer would result in a prompt to articulate their understanding in an open-ended format; it is possible to speculate that at least some participants may have deliberately chosen to avoid this and answered 'not sure' or 'no' instead.

In summary, participants' reported perceptions of their metalinguistic understanding mirrors hypothesised learning difficulty (see Figure 2), mostly descriptively, but sometimes also significantly. It is interesting to note that hypothesised learning difficulty is not reflected in the post-test scores ($N = 108$), which are virtually identical in descriptive terms and show no statistically significant difference between post-test 1 (adjective-noun gender agreement) and post-test 2 (genitive of negation): $t = .419$, $df = 107$, $p = .676$, post-test 1 mean = 50.31%, post-test 2 mean = 49.44%. Taken together, these results suggest that learning difficulty of

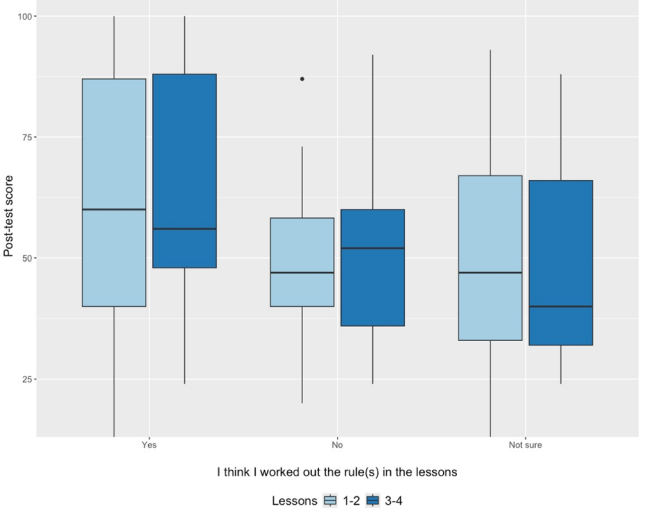

Figure 3. Post-test scores in % by participants' self-reported ability to infer the targeted grammar rules.

specific target features as conceptualised in our study became apparent at the level of self-report rather than in objective L2 performance.

RQ1b: What is the nature of participants' metalinguistic awareness?

Participants who answered 'yes' to the question as to whether they thought they had worked out any grammar rules were prompted to spell out the rules according to their understanding. Not all participants who had stated that they had inferred the rule(s) articulated their metalinguistic awareness, that is, some participants did not respond to the verbalisation prompt. We can only speculate about possible reasons, which may include inaccurate self--assessment, an inability to articulate their thoughts, or simply an unwillingness to formulate open-ended text. A total of 27 participants did provide responses. For adjective-noun gender agreement (Lessons 1 + 2), 24 (77%) of the 31 participants who had answered 'yes' to the question of whether they thought they had worked out the rule attempted a metalinguistic description; for the genitive of negation (Lessons 3 + 4), 17 (81%) of the 21 participants who had answered 'yes' offered a metalinguistic description. There is no indication that input modality influenced participants' attempts to derive and verbalise metalinguistic awareness, with learners who offered metalinguistic descriptions relatively evenly distributed across different conditions (auditory = 10; written = 11; mixed = 6).

Figure 4 provides an overview of the quality of participants' metalinguistic descriptions of the two targets.

Figure 4 indicates that, overall, levels of metalinguistic awareness were relatively low, with ~40% of learners verbalising entirely inaccurate rules as per the scoring criteria shown in Table 3. Out of the total of 24 participants who attempted to articulate the pattern underlying adjective-noun gender agreement, 15 (63%) provided at least partly accurate metalinguistic descriptions. Out of the total of 17 participants who attempted to articulate the regularity underlying the genitive of negation, 11 (65%) offered at least partly accurate metalinguistic descriptions. A total of 7 participants provided at least partly accurate metalinguistic

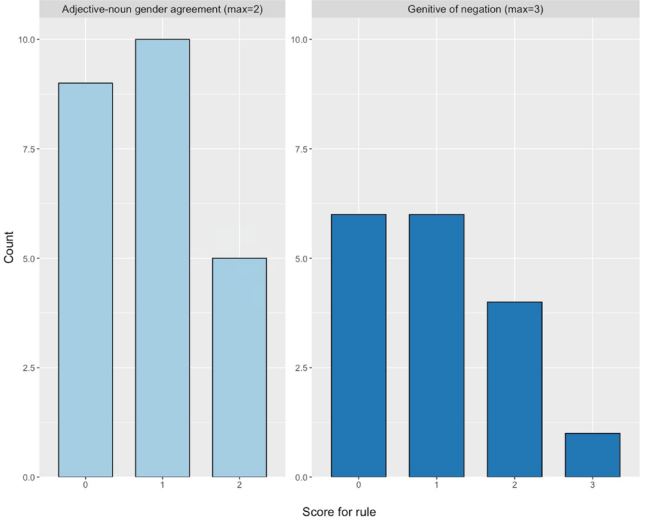

Figure 4. Quality of participants' metalinguistic descriptions (count = no. of participants).

descriptions for both targets. It is worth noting here that the percentages of participants attempting a metalinguistic description and of participants who verbalised at least partly correct metalinguistic descriptions were similar for the two target features, and in fact, descriptively slightly higher for the more complex feature.

While this may seem contradictory at first glance and while it certainly contrasts with our hypothesis about relative learning difficulty, a possible explanation suggests itself: at the metalinguistic level, a quantitative increase in difficulty (i.e. a step up from three to six inflections) may not only be unproblematic but even beneficial, in the sense that more of the same is likely to boost awareness and understanding.

It is possible to argue that a quantitative increase resulted in a shift in emphasis from analytic ability to memory ability. When encountering the target of adjective-noun gender agreement in Lessons 1 and 2, participants had to work out that adjective endings changed in accordance with the gender of the noun that was qualified. This was the analytic challenge. The pattern itself included just three inflections, and one of these was phonologically transparent (feminine -a), so the memory challenge was rather moderate in this context.

By contrast, the memory challenge posed by the inflectional pattern in Lessons 3 and 4 was greater. Not only were there six inflections to deal with, but there was also some opacity in the sense that the neuter genitive ending -a coincided with the previously memorised feminine nominative -a, so the latter association that had just been established had to be replaced, or rather extended. This poses a memory challenge (Ellis, 2005) which we can probably all relate to: it is harder to remember a new phone number or a new car registration plate when we get a new phone or a new car than it was to remember our first phone number or the registration of our first car. The reason for this is that a previous memory trace (the old number or registration) has been entrenched. Therefore, replacing an existing association is more challenging than forming a completely new association.

Importantly, however, the more complex inflectional paradigm presented in Lessons 3 and 4 arguably does not constitute a greater analytic challenge. Once participants had inferred that noun endings differed and that adjective endings could change, they were on the right track. If they solved this problem in Lessons 1 and 2, they could apply an analogous solution in Lessons 3 and 4. The only further step required was to notice the reason for a change in endings: negation—a meaningful, lexicalised form (*nie*) that had previously been introduced in the context of the vocabulary learning phase.[3]

Needless to say, this line of argument is speculative and certainly post-hoc, but it does provide a potential explanation for the observed pattern of results that partly disconfirmed our original hypothesis in relation to learning difficulty.

RQ2: Is participants' reported metalinguistic awareness related to (a) post-test performance, (b) prior language learning experience, (c) language-analytic ability, and (d) perceptions of the instructional materials?

We began addressing the second research question by considering descriptive statistics as shown in Figure 5, and calculating bivariate correlations as shown in Table 5.

The correlational results show a number of positive relationships between variables. First, LLAMA F scores and level of multilingualism are moderately but significantly correlated with

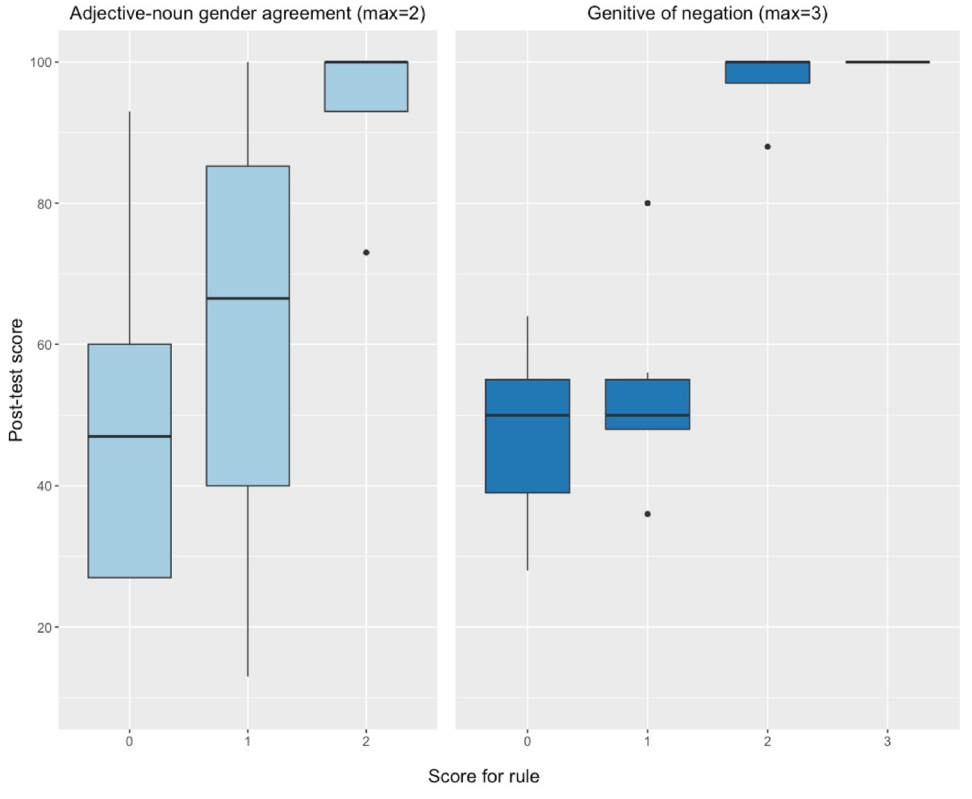

Figure 5. Post-test scores in % by quality of participants' metalinguistic descriptions.

Table 5. Correlations (Spearman's rho) between metalinguistic awareness, post-test performance and selected individual difference variables.

	Score for rule L3 + L4	Post-test 1	Post-test 2	Level of multiling.	LLAMA F	Perceptions of inst. mat.
Score for rule L1 + L2	.892**	.566**	.556**	.392	.356	.102
	$p = .001$	$p = .004$	$p = .005$	$p = .064$	$p = .088$	$p = .634$
	$N = 12$	$N = 24$	$N = 24$	$N = 23$	$N = 24$	$N = 24$
Score for rule L3 + L4	–	.622**	.707**	.463	.293	.383
		$p = .008$	$p = .001$	$p = .071$	$p = .254$	$p = .130$
		$N = 17$	$N = 17$	$N = 16$	$N = 17$	$N = 17$
Post-test 1		–	.476**	.354**	.290**	.197*
			$p = .001$	$p = .001$	$p = .002$	$p = .041$
			$N = 108$	$N = 96$	$N = 107$	$N = 108$
Post-test 2			–	.230*	.327**	.047
				$p = .024$	$p = .001$	$p = .629$
				$N = 96$	$N = 107$	$N = 108$
Level of multiling.				–	.133	.074
					$p = .197$	$p = .475$
					$N = 95$	$N = 96$
LLAMA F					–	.040
						$p = .681$
						$N = 107$

Level of multiling.: level of multilingualism; Perceptions of inst. mat.: perceptions of instructional materials; **: significant at the .01 level; *: significant at the .05 level.

post-test performance. In other words, more extensive language learning experience and greater language-analytic ability are associated with better L2 outcomes—a pattern which underlines the challenging nature of the inductive instructional approach (see also Erlam, 2005). In other words, having to infer the pattern underlying a target feature rather than being presented with a ready-made metalinguistic description draws more heavily on learners' cognitive resources in general and language-analytic ability in particular. The challenge may be compounded further by the online nature of the instructional materials, given that there was no teacher to consult and thus no scaffolding available. In online studies such as ours and indeed others (e.g. Hwu et al., 2014; Hwu & Sun, 2012), participants must rely exclusively on their own abilities. This puts more experienced learners at an advantage, as suggested by the role of level of multilingualism.

Second, the scores reflecting the quality of metalinguistic awareness articulated by participants with regard to the two targeted structures are strongly and significantly correlated, which is indicative of consistency. If learners were able to infer one targeted rule to a high level of success, they were highly likely to be able to do the same for the other targeted rule. This result is in keeping with the argument presented above that a quantitative increase in learning difficulty essentially translates into more of the same.

In response to RQ2(a), metalinguistic awareness scores and post-test scores assessing the respective target structures are positively and significantly associated, that is, participants with greater metalinguistic awareness performed better (for a visual representation of this result, see Figure 5). This finding is consistent with previous research carried out with literate, educated adult samples (e.g. Absi, 2014; Alderson et al., 1997; Gutiérrez, 2016; Renou, 2000; Roehr, 2008). In the case of the present study, the association between metalinguistic awareness and L2 achievement is of medium strength and stronger in the case of the more complex target (rho = .57 for adjective-noun gender agreement and rho = .71 for the genitive of negation). This result chimes with the findings arising from a previous study with L1 Australian English learners of L2 Chinese (Elder & Manwaring, 2004): correlations between metalinguistic knowledge and L2 achievement emerged at beginner level where participants attempted to learn a typologically unfamiliar language, just as in the present study.

In response to RQ2(b), metalinguistic awareness scores show a trend towards a correlation with level of multilingualism; the coefficients are of moderate strength but do not quite reach statistical significance. This trend makes intuitive sense, since greater language learning experience is likely to help with arriving at metalinguistic generalisations in an inductive context and with being able to articulate these generalisations. Learners who have acquired more languages and learners who have learned languages to a higher level of proficiency can be expected to develop higher levels of metalinguistic awareness. As we encounter more languages and/or as our proficiency in a specific language grows, our knowledge representations become increasingly structured and explicit (Bialystok, 2001; Roehr-Brackin, 2025). Cognitively mature learners are able to verbalise their thoughts about language, with instructed learners able to use the metalinguistic terminology or metalanguage they have encountered (Ellis, 2004; Roehr, 2006). We make comparisons between languages (Cenoz & Jessner, 2009) and we discover effective learning strategies (Jessner, 2008, 2014). The present result aligns with existing findings (Donnerer, 2024; Roehr & Gánem-Gutiérrez, 2009), although the absence of any relationship arising from a study with a homogeneous group of highly experienced university-level learners has also been reported (Roehr-Brackin et al., 2021).

In response to RQ2(c), we can observe a trend towards a correlation between language-analytic ability as measured by LLAMA F and metalinguistic awareness about adjective-noun gender agreement, whereas no such trend is in evidence for the genitive of negation. At first glance, this may seem surprising because one would expect a greater role for language-analytic ability in the context of the more difficult linguistic target. However, as argued above, the increase in complexity was quantitative rather than qualitative in nature, with adjective-noun gender agreement relying on three inflections and the genitive of negation involving six inflections, that is, it was essentially more of the same. Viewed in this light, the results are arguably coherent: good language-analytic ability was needed to work out the systematicity underlying the first target, but once that had been achieved, the second target did not represent any additional analytic challenge. Instead, additional memory capacity was likely needed (see also Hwu & Sun, 2012), but this variable was controlled for through our research design, given that participants had already achieved at least 90% accuracy on the preceding vocabulary test in order to even start the lessons.

In response to RQ2(d) from a quantitative perspective, we did not find any significant associations between participants' metalinguistic awareness and their perceptions of the instructional materials.

Addressing RQ2(d) from a qualitative perspective, we thematically coded the responses provided by participants who articulated metalinguistic awareness to the open-ended questionnaire items asking about what learners liked and what they disliked about the language lessons they had worked through. Table 6 summarises the results, with the numbers in brackets indicating the frequency with which each theme was mentioned. Positive points are ordered by frequency, negative points are ordered to match the themes of the positive points, where possible, with the aim of highlighting the contrasting nature of several of the likes and dislikes.

It is worth noting that although the second row in Table 6 presents a positive perception on the left-hand side and a negative perception on the right-hand side, both themes point in the same direction in that they appear to express a preference for mixed-modality input: visual or pictorial support is appreciated, but auditory input is desired too. This interpretation is borne out quantitatively by participants' responses to another questionnaire item which asked them to rank-order input modalities in accordance with their preference. Mixed-modality input was ranked first by the majority of learners ($N = 16$ or 55%), while written input ($N = 8$ or 28%) and auditory input ($N = 5$ or 17%) were ranked first by fewer learners.

Apart from this consistency in views, the results in Table 6 indicate a fairly direct contrast between the themes listed under likes and dislikes. For instance, while several participants considered the vocabulary learning phase an interesting and essentially easy task, others

Table 6. Participants' likes and dislikes of the instructional materials.

Likes	Dislikes
Vocabulary was interesting/easy (10)	Memorisation demands/many endings (3)
Pictorial support (7)	Lack of auditory input (4)
Language was practical/relevant to daily life (6)	Generally difficult/complicated (7)
Something to work out by oneself/a challenge (5)	Grammar rules/learning goal not stated explicitly (3)
Practice opportunities (2)	Lessons were boring/repetitive (2)
Use of a storyline (2)	Receptive materials only (2)
Learning letters specific to Polish (1)	Very different from known languages (2)
	No bilingual support/fast speech (2)

regarded the need to memorise many words and/or inflections as a downside. By the same token, several learners appreciated the challenge of the inductive instructional approach, while others complained about the absence of metalinguistic explanations. In summary, and more often than not, one person's likes were another person's dislikes.

In such a scenario, it is quite clear that a single set of instructional materials will never please all learners who are asked to engage with it. This is not surprising, of course, but it may be reassuring for teachers and/or materials designers who are tasked with developing instructional activities for heterogeneous groups of learners. At the same time, it points towards the potential opportunities afforded by user-responsive technologies. If we can individualise (some) instructional materials in accordance with learners' specific preferences, this will no doubt lead to more positive perceptions and, ultimately, perhaps also to faster and more successful L2 development.

Conclusion

The present study investigated whether and to what extent adult participants developed metalinguistic awareness about two morphological features targeted in the context of an inductive instructional approach at complete beginner level. We examined the association of learners' metalinguistic awareness with learning outcomes and prior language learning experience as well as a cognitive and a metacognitive variable that had previously been shown to relate to metalinguistic awareness, that is, language-analytic ability and learners' perceptions, respectively.

In line with existing studies, we identified positive relationships between metalinguistic awareness and accurate use of the two targeted structures in the context of the respective post-tests. At the same time, participants' metalinguistic awareness was relatively low in both quantitative and qualitative terms, given that a sizeable majority of learners reported that they could not work out the systematicities underlying the target features and that 40% of those learners who thought they had worked out the systematicities provided completely inaccurate metalinguistic descriptions. Taken together, these findings are testimony to the challenge of an inductive instructional approach implemented at beginner level and focusing on an L2 that is typologically distant from languages known to the participants.

While post-test performance did not differ significantly for the two target features, the hypothesised difference in learning difficulty was observable in learners' reported metalinguistic awareness. More participants professed to having worked out the less complex target (adjective-noun gender agreement) than the more complex target (genitive of negation), which is indicative of consistency between participants' metacognitive self-assessment and hypothesised learning difficulty.

At the same time, similar percentages of participants (a) attempted to articulate metalinguistic awareness and (b) were able to provide at least partly accurate metalinguistic descriptions of the two targets, with percentages slightly higher in descriptive terms for the more complex target (genitive of negation) than for the less complex target (adjective-noun gender agreement). Furthermore, a correlational trend indicates that good language-analytic ability appeared to be required for deriving accurate metalinguistic awareness about the less complex but not about the more complex target. Taken together, these findings suggest that a quantitative step change from a less complex to a more complex inflectional pattern may actually have boosted learners' metalinguistic awareness, precisely because they

encountered more of the same. In this sense, then, greater hypothesised learning difficulty seemingly did not have an adverse but a facilitative effect.

Notes

1. By asking only participants who thought they had worked out the targeted features to verbalise any metalinguistic rules, we relied on learners' self-evaluation of their knowledge. As rightly noted by a reviewer, this means that participants who were unsure about their own knowledge were not given the opportunity to articulate their thoughts.
2. Reliability and normality analyses as well as results arising from variables not considered in the present paper can be found in Roehr-Brackin et al. (2024).
3. A reviewer pointed out that meaningful targets may have yielded different results from the form-based features with little or obscure semantic content (case) or indeed no semantic content (grammatical gender) which were the focus of our study. We agree with this view; meaningful features may well be inferred more readily in the context of an inductive instructional approach.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Notes on contributors

Karen Roehr-Brackin is a Reader in Applied Linguistics in the Department of Language and Linguistics and director of the Centre for Language Across the Lifespan at the University of Essex. Her research focuses on explicit and implicit knowledge and processes in additional or second language learning at different ages (children, young adults, older adults) as well as the role of individual differences, in particular language learning aptitude, working memory, and metalinguistic awareness. Her work has been published widely in international peer-reviewed journals, and she is the author of a monograph on metalinguistic awareness in second language acquisition (2018).

Karolina Baranowska (PhD) is an assistant professor in the Faculty of English at Adam Mickiewicz University in Poznań, Poland. Her main research interests revolve around second language acquisition. More specifically, she is interested in the role of exposure to video-based materials in foreign language learning, cognitive load theory, and psycholinguistics. She is also involved in teaching English as a foreign language at academic level.

Renato Pavlekovic is a visiting fellow and quantitative researcher in the Department of Language and Linguistics at the University of Essex, specialising in the cognitive processes involved in second language (L2) acquisition. His research investigates how individual differences, such as language aptitude and working memory, influence L2 learning outcomes. A central focus of his work is understanding how these cognitive abilities interact with L2 proficiency, the difficulty of linguistic structures, and instructional settings to optimise learning based on learners' cognitive profiles. His recent work also explores how these cognitive abilities evolve with age and examines the benefits of language learning in older adulthood.

Paweł Scheffler is a professor in the Faculty of English at Adam Mickiewicz University in Poznań, Poland. His research interests are second language acquisition, classroom foreign language instruction, and modern English grammar. He has published in a variety of research and professional journals both in Poland and abroad. He also writes language learning materials for Polish students of English and produces online grammar courses for teachers of English.

ORCID

Karen Roehr-Brackin http://orcid.org/0000-0002-1152-5852
Karolina Baranowska http://orcid.org/0000-0003-0639-0719
Renato Pavlekovic http://orcid.org/0000-0002-5955-0379
Paweł Scheffler http://orcid.org/0000-0002-8130-8095

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