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# Learners' Awareness of Hedges and Boosters in Academic Discourse – A Study on Serbian Agriculture Students

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**Abstract:** The paper focuses on the extent to which ESP students are able to distinguish the authors' commitment towards a claim on the continuum from uncertainty to certainty in academic writing. Relying on Hyland's extensive research in the field, we seek to explore whether hedges and boosters, being on the very ends of the mentioned continuum, represent items (in)visible to ESP students. Study participants were bachelor's and master's degree students of the Faculty of Agriculture, University of Belgrade, Serbia (N=91). They filled out the questionnaire, asking them to first assess the author's degree of commitment (certainty, probability, possibility) in 15 sentences modeled on authentic sentences from RAs, and then state the words/expressions in each sentence that led them to make such a choice. The results reveal that students in both groups are better at recognizing certainty markers than those of probability and possibility. Although master's degree students received prior instruction on the concept of hedges and boosters, there are no significant differences between the two groups in terms of achievement. Nevertheless, achievement in both groups is largely affected by the participants' level of proficiency.

**Keywords:** *Serbian ESP learners, hedges, boosters, certainty/probability/possibility markers, lexical (in)visibility*.

## La Conciencia de los Estudiantes sobre los Atenaudores e Intensificadores en el Discurso Académico - Un estudio sobre los Estudiantes de Agricultura

**Resumen:** El trabajo se centra en la medida en que los estudiantes de inglés con propósitos específicos están capaces de diferenciar la determinación de los autores hacia el continuo desde incertidumbre hasta certidumbre en la escritura académica. Basándose en la extensa investigación de Hyland en el campo, buscamos explorar si los atenuadores e intensificadores, estando en los extremos del continuo mencionado, representan los elementos (in) visibles para estudiantes de inglés con propósitos específicos. Los participantes en el estudio fueron estudiantes de licenciatura y estudiantes de máster de la Facultad de Agricultura, Universidad de Belgrado, Serbia (N=91). Ellos rellenaron el cuestionario, en el que les pedimos que evalúen el nivel de compromiso del autor (certeza, probabilidad, posibilidad) en 15 frases modeladas basándose en frases auténticas del artículo de investigación, y después les pedimos que confirmen las palabras/expresiones en cada frase que les llevaron a tomar esa decisión. Los resultados revelan que los estudiantes en ambos grupos son mejores en reconocer marcadores de certeza que reconocer los marcadores de probabilidad y posibilidad. Aunque los estudiantes de máster recibieron la instrucción previa sobre el concepto sobre los atenuadores e intensificadores, no existe la diferencia significativa entre dos grupos en términos de éxito. No obstante, el éxito de ambos grupos en gran parte fue afectado por el nivel de habilidad de los estudiantes.

**Palabras clave:** *estudiantes serbios de inglés para fines específicos, atenuadores, intensificadores, marcadores de certeza/probabilidad/posibilidad, (in)visibilidad léxica*.

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## 1. Introduction

The interest in different features of academic writing has been longstanding and has focused on both the scientific discourse of experienced writers and the production of secondary school and university students writing in their non-native languages. Many features of academic writing have been the focus of different models in the pertinent literature, e.g. metadiscourse and its characteristics, modality, passive voice, tenses, conditional clauses, and academic vocabulary, along with various instructions and conventions required for mastering the skill of writing for academic purposes (e.g., Baratta, 2009; Crosthwaite et al., 2017; Gablasova et al., 2017; Hyland, 1998a, 1998b, 2005a; Vázquez Orta, 2010; Simon-Vandenbergen, 2008).

Bearing in mind the importance of metadiscourse (MD) features in academic writing, a plethora of studies in this field analyzed the use and functions of MD devices, hedges and boosters among them, in ESP student writing (e.g., Crompton, 2012; MacIntyre, 2017; Vesić Pavlović & Đorđević, 2020a). On the other hand, fewer studies explored whether students can recognise MD features in academic texts and the extent to which they were able to do so (e.g., Hyland, 2000; Takimoto, 2015). This is relevant because of the importance of teaching students to correctly interpret the author's intentions when analyzing and using academic sources and to subsequently use hedging and boosting devices adequately in their own academic writing in a foreign language. It is argued that it is frequently difficult for second language learners to understand various authors' methods for making differences between assumptions and facts and to assess the truth value of claims, which is crucial to understanding academic publications (Hyland, 2000, p. 179).

In this paper, inspired by Hyland's study (2000), we aim at analyzing whether Serbian bachelor's and master's degree ESP students are able to recognize the nuances of authors' claims (certainty, probability, possibility) in academic writing, expressed via devices such as hedges and boosters, as well as whether they base their decisions on proper lexical choices. Further, we aim at exploring whether there is a difference in the extent of noticing hedges and boosters, as well as if such factors as previous exposure to the topic of MD use in academic writing and the level of students' proficiency make a difference. Our analysis is conducted in the context of Serbian ESP learner discourse and, as such, may bear additional relevance since very few studies have focused on this linguacultural background.

Research participants were bachelor's and master's degree students of the Faculty of Agriculture, University of Belgrade, Serbia (N=91), attending university ESP courses. The difference between these two groups was that master's degree students were explicitly instructed during their course on the use of MD markers in the context of academic writing, while bachelor's degree students received no such instruction. Both groups filled out a questionnaire compiled for the purposes of the research (elaborated in detail in Section 4). The results obtained in this way were processed both quantitatively and qualitatively and shown in Section 5, while Section 6 contains concluding remarks.

## 2. Theoretical and cultural background of the study

Writers can express different degrees of commitment towards the content of their propositions on the continuum from uncertainty to certainty. The notion of hedges is used to "indicate the writer's decision to withhold complete commitment to a proposition, allowing information to be presented as an opinion rather than accredited fact" (Hyland, 2005b, p. 178); the traditional examples of hedges would include words such as *possible*, *might* and *perhaps* (ibid). The function of boosters is to "allow writers to express their certainty in what they say and to mark involvement with the topic and solidarity with their audience" (Hyland, 2005b, p. 179), using, for instance, words such as *clearly*, *obviously* or *demonstrate* (ibid). Through a careful use of these devices, writers decide on the degree of their commitment to the claims (Hyland, 2005b, p. 180). The related notions of certainty, probability and possibility are mentioned within the context of systemic functional linguistics. According to Halliday and Matthiessen (2014), language allows us to convey not just facts, but also our understanding of the likelihood of events or situations, allowing authors to express different shades of meaning and convey their level of confidence in a particular statement. They argue that expressions such as 'possibly,' 'probably,' and 'certainly' indicate different levels of likelihood, implying 'either yes or no,' and meaning maybe yes, maybe no, with varying degrees of certainty. In other words, there is nuanced interplay between certainty, probability, and possibility, implying that "in between the certainties of 'it is' and 'it isn't' lie the relative probabilities of 'it must be', 'it will be', 'it may be'." (2014, p. 176). Boosters serve as the expression of certainty, while hedges express either possibility or probability. This is of great importance because, when it comes to writing, whether academic or otherwise, these devices may be quite helpful to nuance views and positions.

Since this study is conducted in a specific cultural background, it should be noted that previous research has shown that Serbian authors tend to use fewer hedges compared to their English counterparts in academic writing (Đorđević, 2017a). This distinction can be attributed to several factors rooted in the linguistic and cultural differences between Serbian and English.

In English academic discourse, hedging is commonly used to soften a statement, a practice that differs from Serbian academic discourse where this approach is not as prevalent (Đorđević, 2017a). Several studies point to such a conclusion. In their investigation of the use of epistemic markers in English and Serbian research articles from the fields of psychology, agriculture, and mechanical engineering, Đorđević and Vesić Pavlović (2021) found that markers of high epistemic modality were more frequent in the articles in Serbian compared to those written in English, hence implying that authors of research articles in Serbian were more inclined to strengthen their statements in comparison to the authors writing in English. In addition, while exploring the use of epistemic modality hedges in research articles from the fields of civil engineering, linguistics, agriculture and medicine, Đorđević (2017b) found that English linguistics research articles exhibited the highest frequency of epistemic modality hedges, whereas Serbian agricultural articles showed the lowest frequency of these devices.

Similar findings were observed in the study by Vassileva (2001), who explored the nuances of academic writing in English, Bulgarian, and Bulgarian-English contexts, shedding light on the differences in the use of hedges and boosters across these languages. The findings of this study may be relevant because Bulgarian is another language belonging to the group of Slavic languages, the same as the Serbian language. Vassileva's results indicate that English academic writing often employs hedges to convey cautiousness and detachment, reflecting a preference for objectivity and precision. In contrast, Bulgarian academic writing, along with Bulgarian-English academic writing, tends to use boosters more frequently, emphasizing confidence and assertiveness. The hybrid genre of Bulgarian-English academic writing does not definitely indicate native language transfer, but rather implies deviations from both Bulgarian and English academic writing conventions. These distinctions reflect not only linguistic variances, but also cultural and rhetorical preferences, shaping the way scholars present their ideas and arguments in academic discourse in these languages.

## 3. Previous research

A plethora of studies have investigated the use of hedges and boosters in academic writing. Holmes (1982) was among the first to focus on the ways of expressing doubt and certainty in English and the difficulties encountered by EFL students when determining the level of the author's certainty expressed in the text. Hyland (1998b) analyzed both boosters and hedges within the academic knowledge mediation context in eight different disciplines belonging to both the sciences and the humanities. The findings showed that hedges outnumbered boosters by almost three to one in all disciplines; additionally, in the group of disciplines Hyland labeled as 'soft', such as philosophy or linguistics, booster and hedge frequencies were much higher than in the fields belonging to the so-called 'hard disciplines', such as physics or engineering. Based on these results, Hyland argues that there are significant disparities in the disciplinary conventions of use of different rhetorical strategies, which may affect the authors' preferred rhetorical devices (Hyland, 1998b, pp. 357–358, 373). The studies by Vázquez and Giner (2008, 2009) further confirmed the existence of differences in hedge and booster use in different knowledge disciplines.

Many studies have pointed out the importance of investigating the language learners' use of MD features, hedges and boosters among them, in their academic writing, as well as working on enhancing learners' proper understanding of the strategies used to communicate authors' intention (e.g., Hyland & Milton, 1997; Ho & Li, 2018; Intaraprawat & Steffensen, 1995; Li & Wharton, 2012; Vesić Pavlović & Đorđević, 2020b). The identified patterns of use of hedges and boosters in students' essays seem to vary depending on a specific study. Some studies determined that, when writing essays, students tended to overuse boosters compared to hedges (e.g., MacIntyre, 2017, on the sample of Japanese university students). On the other hand, in Serbian university students' essays produced during ESP classes, hedges were much more frequent in comparison to boosters (Vesić Pavlović & Đorđević, 2020a).

Research has also shown that the ability to use hedges in writing by non-native speakers may depend on the writers' level of proficiency. Inesa Šeškauskienė's study (2008) on hedges employed in the introduction of graduation papers written by Lithuanian English majors indicated that L2 users who had reached an advanced degree of language competence and been instructed in the use of MD features were able to express themselves clearly and employ the most effective discourse strategies, including hedging to a vast extent. In Hyland and Milton's (1997) research, higher ability non-native students used probability and possibility markers more frequently, whereas less proficient non-native students used a substantially higher percentage of certainty items, implying that more proficient students tended to produce more tentative statements (Hyland & Milton, 1997, p. 195).

Metapragmatic awareness of hedges can be raised in the classroom as well. For instance, Wishnoff's study (2000) has shown that various modes of instruction pertaining to hedges (e.g., discussing the notion of hedges and their use, showing examples of hedges in academic papers, performing tasks related to the identification of hedges) affected the performance of the group of graduate students learning English in that they used more hedges when writing academic texts. Still, it was also found that the effect of instruction in this case again partly depended on the language proficiency of the learners.

There are several studies that bring important insights into the complex problem of awareness of hedges and boosters in academic texts, both when it comes to the EAP students and the authors themselves. The first amongst these was a small-scale study on awareness of intensifiers and hedges conducted with native speakers of English by Low (1996), based on which he formulated his Lexical Invisibility Hypothesis. It states that respondents are not largely aware of intensifiers and even much less of hedges in a text, regarding them as invisible (Low, 1996). Hyland (2000) further tested and confirmed the hypothesis on the sample of L2 English learners.

Participants in Hyland's study were first and final-year BA students, native speakers of Cantonese, and fairly proficient in English. They were first asked to read a short passage on language learning strategies, rife with hedging and boosting devices, and answer questions about the text. After that, they were given a questionnaire that asked them to mark each of the 15 statements from the text regarding the degree of writer's certainty: "completely certain", "fairly sure" or "uncertain". This was followed by a think-aloud protocol where students were supposed to state the words and expressions that helped them make the choice in the task. It was found that students were more aware of boosters than of hedges, as well as that they were more successful in assigning the right degree of author's commitment to the sentences containing certainty items than to those with probability and possibility markers. According to the findings of think-aloud procedures, participants mostly based their choice on lexical words rather than target items, which often led them to make incorrect conclusions (Hyland, 2000, p. 184).

Takimoto (2015) explored the ability of non-English majors from Japan to recognize hedges and boosters in English texts. His participants had a similar task as the one in Hyland's study (2000), namely, to rate each of the 12 statements from the previously

presented passage according to writer's degree of certainty (completely certain, fairly sure, uncertain). The results indicate that participants were able to identify certainty markers, but struggled to understand the pragmatic functions of the possibility and probability items, especially the meanings of and different degrees of tentativeness carried by *could*, *possible(-ly)* and *probable(-ly)* (Takimoto, 2015, p. 95).

Lewin (2005) investigated awareness of hedges through two carefully devised studies; the first asked of authors to identify the expressions used to tone down the statements in their own texts, while the second asked PhD students who attended courses in EAP academic writing to highlight the words, phrases or statements that the authors used to tone down their claims in the same sets of texts. It was shown that authors' awareness of using hedges in their own work was fairly low and that they did not recognize many expressions traditionally considered as hedges in the literature in their own work. Surprisingly, students were the ones who more correctly identified hedges than authors, i.e., "there was more agreement between readers and linguists than between authors and linguists" (Lewin, 2005, p. 170). This study raises important issues such as that, due to a divergence in the author's interpretation of their hedging strategies and the reader's understanding of their intentions, readers may interpret certain claims as more hedged than intended by the author, and at the same time miss some of those that were used by authors to tone down their arguments.

According to the results of previous studies in the field, there are a variety of factors that should be taken into consideration when investigating the ways in which EFL students both employ and identify boosting and hedging devices in academic writing. Students' knowledge of the existence of discursive strategies and of their appropriate use can considerably help their ability to appropriately use or identify these linguistic units, and their level of English command comes next. Also, explicit instructions regarding these linguistic markers should enable their more adequate identification. Having been taught about boosters and hedges in their English language courses, master's degree students should be more knowledgeable of these language devices and, as a consequence, more successful in the tasks of their identification. Cultural and discipline-specific conventions may have an impact on how boosters and hedges are used and recognized, but earlier research showed that boosters were typically easier to identify than hedges, irrespective of explicit instructions.

Hence, bearing all this in mind, we proceed with the following hypotheses:

- H1: Previous input regarding the use and main functions of boosters and hedges should facilitate noticing these markers; hence, master's degree students will be better at identifying boosters and hedges than the bachelor's degree students;
- H2: All students will be able to identify boosters more easily than hedges;
- H3: Students' ability to recognize boosters and hedges will depend on their level of proficiency.

## 4. Materials and methods

*Research background.* Research participants were bachelor's and master's degree students of the Faculty of Agriculture, University of Belgrade, Serbia, all native speakers of Serbian. For master's degree students, the English language is an obligatory course at the university (3 classes per week in the 1st semester) for one semester. Bachelor's students selected the English language course among other offered language courses and they had 4 classes per week for one semester in the 2nd semester of studies. At the beginning of their respective course, both groups of students were asked to take a placement test comprised of 60 multiple-choice questions in order to assess their English proficiency levels (ranging from A1 (the lowest) to C2 (the highest)).

Apart from the level of studies, two groups of participants were different in terms of the received input regarding the use and main functions of MD markers, including hedges and boosters, in academic writing. Namely, master's students were explicitly exposed to the topic of metadiscourse during their ESP course, with a special emphasis on boosters and hedges. Having learned about various MD classifications and functions of MD markers, during their regular university classes, they completed different tasks, such as identifying MD markers in research articles in English, deciding on which MD marker type these belonged to, and, finally, summarizing a part of a chosen research article using the MD markers, especially hedges and boosters. Bachelor's students were not exposed to any explicit lecturing, either on MD markers or hedges and boosters, during the ESP classes they attended at the university.

*Sample structure.* The sample of master's students included 42 participants in total, with 64.3 % female and 35.7 % male students. The mean age of students in this sample was 25.5 (SD=2.58). According to the placement test, the majority of students were at A2 and B1 levels of English language proficiency (A1–2.4 %, A2–52.4 %, B1–38.1 %, B2–4.8 %, C1–2.4 %). In the bachelor's students' sample (N=49), there were 46.9 % female students and 53.1 % male; their mean age was 19.4 (SD=1.57). The majority of students had level B1 English proficiency, followed by levels A2 and C1 (A1–2 %, A2–26.5 %, B1–46.9 %, B2–4.1 %, C1–20.4 %). The language proficiency levels were significantly different in these two groups of students, $t(89)= 3.09$, $p<.01$, with the bachelor's students having a slightly higher average language proficiency (M=3.1) than the master's students (M=2.5). Although this is quite a small difference, additional efforts were made to control for its statistical effects when comparing the two groups of students.[1]

*Questionnaire.* Respondents were first asked to provide their gender and age. This was followed by an instruction in Serbian, which explained that they were supposed to provide the assessment of the author's commitment to the claim in the given sentences.[2]

[1] Language proficiency is, nevertheless, one of the most important variables used in the analysis.

[2] Translation of the instruction: "We would like you to carefully read each of the sentences below and decide whether the authors of each sentence were 'completely certain', 'fairly sure' or 'uncertain' about the claims expressed in each of the sentences. If you cannot decide, you can respond with 'I don't know'."

The respondents were shown 15 sentences[3] (in randomized order), each accompanied by four options: 1) *completely certain*, 2) *fairly sure*, 3) *uncertain* and 4) *do not know* and asked to assess how certain the author was in making the claim. The data obtained in this section of the questionnaire were later coded into correct and incorrect answers and processed quantitatively, while additional qualitative analysis was performed on the raw data for each sentence. This part of the questionnaire showed acceptable reliability (raw sentences–α=.69, recoded correct/incorrect sentences–α=.63; by a statistical rule of thumb, alpha values >.60 are considered moderated but acceptable, Pallant, 2001). The validity of this measure proved to be good as well. The mean item-total correlation for all 15 items was .36, and ranging from .55 to .77 for the correlations between the achievement on three subdomains and the overall achievement. All these satisfy the criteria typically set for high validity (Cohen, 1988). In addition, the overall achievement was significantly and moderately related to the language proficiency level, $r$=.30, $p$ < .001, further demonstrating the criterion validity of this measure.

Then, the sentences were shown to participants again, one by one, but this time they were asked to state the word(s) or expression(s) from each sentence which helped them decide about the assessment of the author's certainty to the claim in that particular sentence.[4] The answers were coded as correct or incorrect[5] and this part of the questionnaire showed high reliability and validity as well. Internal consistency was high (α=.89), while the mean item-total correlation was also of a high value, $r_{mean}$= .62; the significant and moderate correlation with the language proficiency level was registered, $r$=.39, $p$ < .001.

*Sentence selection*. The sentences shown to students were modeled on authentic sentences extracted from research articles published in two eminent, field-relevant journals: *Crop Protection* and *Field Crops Research.* In modeling the sentences, special attention was paid to the fact that they should comprise both familiar technical vocabulary, as well as the targeted markers (hedges and boosters) (Table 1). As such, this procedure was an initial step in securing the face validity of the applied measures used in the questionnaire.

**Table 1.** The list of target items featured in the sentences in the questionnaire.

| | **Target items in the questionnaire** |
|---|---|
| Hedges | suggest that; it seems that; it appeared that; may consider; may examine; might extend; potential; possible, may affect; probably, it has been assumed that; it is thought that; presumably; potential |
| Boosters | showed; demonstrate; clearly; obviously |

[3] See Appendix 1 (target items in sentences are underlined).

[4] Translation of the instruction: "Now we would like you to state the word(s) from every sentence which helped you decide earlier how certain the writer was in making these statements."

[5] In the sentences which contained several possible indicators of the author's degree of commitment, it was sufficient to state one of the correct answers.

Further, target items in sentences were selected so that they expressed different degrees of author's commitment, namely, certainty (expressed by boosters) and probability and possibility (expressed by hedges). Table 2 shows the numbers of sentences in which each of the markers from three categories were featured (see Appendix 1 for sentences' wording).

**Table 2.** The presence of certainty, probability and possibility markers in individual sentences in the questionnaire.

| | **Sentence number** |
|---|---|
| Certainty | 2, 4, 7, 11 |
| Probability | 3, 5, 10, 12, 13, 14 |
| Possibility | 1, 6, 8, 9, 15 |

*Research course*. Participation in research was voluntary and anonymous, in exchange for course credits. Respondents filled in the questionnaire online, via Google forms, during their regular ESP class[6]–master's degree students at the end of the first semester of academic year 2021/22, bachelor's degree students at the end of the second semester of the same academic year. An equal amount of time, specifically 45 minutes, was allotted to both the master's and bachelor's degree student groups for completing the questionnaire. This careful allocation of time was designed to create a level playing field for all participants, ensuring that the data collected from both groups were comparable and reliable.

*Data analysis*. Several standard statistical tests were used in the quantitative analysis, in accordance with the types of variables (numerical or categorical) and the number of groups compared. Pearson's coefficients of correlation ($r$) were utilized to analyze the patterns of covariation between two numerical variables. The significance of differences in the mean values in the numerical variables between two groups was analyzed by means of an independent $t$-test, and the significance of mean differences in the numerical values between more than two groups of students by means of a one-way (in case of one independent variable) and two-way (in case of two independent variables) analysis of variance (ANOVA). A paired sample $t$-test was used to test the differences in the means of the same group of respondents on two different numeric variables. The significance of differences in the frequency distribution of categorical variables was analyzed by a chi-square test and Cramer's $V$ coefficient.

[6] Since the first author of the study also served as the instructor for both the master's and bachelor's degree student groups, to mitigate any potential researcher expectancy effects, several measures were implemented: detailed and standardized instructions were provided to both groups, ensuring consistency in the information given to participants; the data analysis was conducted using predefined protocols to reduce the potential for subjective interpretation of results; the study underwent rigorous peer review within our research team, and their external perspectives helped in identifying and addressing any potential biases or expectancy effects that might have been overlooked.

## 5. Results

The results will be presented in several subsections. First, we focus on the results of the quantitative analysis of the data obtained via the questionnaire; we present (1) differences in the achievement of master's versus bachelor's degree students' subsamples, (2) differences in the achievement in the sentences containing boosters versus those containing hedges, and (3) the relationship of achievement with students' language proficiency. After that, we briefly report on the results of the qualitative analysis of the students' incorrect answers in the items requiring them to select the proper indicator of the author's commitment.

### 5.1 Assessment of the degree of author's commitment — Master's versus Bachelor's degree students

Table 3 shows a summary overview of students' assessment of the degree of the author's commitment in 15 sentences, with the percentage of correct answers given in bold. Several pieces of information are deemed relevant here.

**Table 3.** Assessment of the degree of the author's commitment in both samples (in %).

| | Certainty | | Probability | | Possibility | | DK | |
|---|---|---|---|---|---|---|---|---|
| Sent. No. | *Master* | *Bachelor* | *Master* | *Bachelor* | *Master* | *Bachelor* | *Master* | *Bachelor* |
| 1 | 21.4 | 32.7 | 66.7 | 55.1 | **0** | **10.2** | 11.9 | 2 |
| 2 | **81** | **77.6** | 9.5 | 10.2 | 7.1 | 10.2 | 2.4 | 2 |
| 3 | 11.9 | 28.6 | **50** | **55.1** | 33.3 | 16.3 | 4.8 | 0 |
| 4 | **71.4** | **77.6** | 16.7 | 16.3 | 9.5 | 4.1 | 2.4 | 2 |
| 5 | 26.2 | 18.4 | **47.6** | **49** | 14.3 | 28.6 | 11.9 | 4.1 |
| 6 | 4.8 | 20.4 | 28.6 | 32.7 | **52.4** | **46.9** | 14.3 | 0 |
| 7 | **69** | **81.6** | 4.8 | 8.2 | 16.7 | 10.2 | 9.5 | 0 |
| 8 | 16.7 | 36.7 | **54.8** | **51** | 19 | 12.2 | 9.5 | 0 |
| 9 | 2.4 | 18.4 | 23.8 | 28.6 | **61.9** | **51** | 11.9 | 2 |
| 10 | 2.4 | 6.1 | **54.8** | **53.1** | 40.5 | 38.8 | 2.4 | 2 |
| 11 | **69** | **59.2** | 16.7 | 16.3 | 9.5 | 24.5 | 4.8 | 0 |
| 12 | 4.8 | 14.3 | **71.4** | **49** | 14.3 | 32.7 | 9.5 | 4.1 |
| 13 | 7.1 | 22.4 | **61.9** | **59.2** | 16.7 | 16.3 | 14.3 | 2 |
| 14 | 11.9 | 12.2 | **42.9** | **46.9** | 35.7 | 38.8 | 9.5 | 2 |
| 15 | 54.8 | 53.1 | 19 | 10.2 | **19** | **36.7** | 7.1 | 0 |

Overall, in all but two sentences, the absolute or relative majority[7] of master's degree students provided the correct answer. Master's degree students were by far the most successful in assessing the author's commitment in Sentences 2 (81 % of correct answers), 4 (71 %), 7 (69 %), 11 (69 %) (all containing boosters), and 12 (71 %, containing hedges). In total, in eleven out of thirteen correctly answered sentences, the absolute majority (>50 %)

[7] The term *absolute* majority denotes more than one half of the respective group of students (>50 %). The term *relative* majority describes the situation when one type of answer is in the majority, i.e. the most frequent, but still below the 50 % of the total group.

of master's degree students provided a correct answer; in two cases, namely, in Sentences 5 and 14, the correct answer was given by a relative majority of students (48 % and 43 %, respectively). On the other hand, none of the participants in this group provided a correct answer regarding the degree of the author's certainty in Sentence 1, which contained a hedge expressing possibility; a very low percentage (19 %) managed to give a correct answer in Sentence 15, which also contained a possibility marker.

Similarly, either the absolute or relative majority of bachelor's degree students managed to provide a correct answer in all but two sentences. They managed to infer the author's degree of commitment more accurately in Sentences 2 (78 %), 4 (78 %) and 7 (82 %), which contained certainty items. In the remainder of the correctly answered sentences, the success rate was between a relative majority of 47 % (sentence 6) and an absolute majority of 59 % (sentence 11). Similar to the master's degree students' sample, the lowest percentage of correct answers was given for Sentence 1 expressing the notion of possibility, with only 10.2 % of students correctly inferring the degree of the author's commitment, as well as Sentence 15, where 36.7 % provided a correct answer.

Yet, the similarity in response patterns in two students' subsamples does not reveal much regarding the possible differences in their mean achievement. In order to test it, we summarized the presented data a bit differently. Taking into account the achievement on this set of questions (assessing the degree of author's commitment) as a whole, students could score from 0 to 15 correct answers. Master's degree students had an average achievement of 7.7 correct answers and bachelor's degree students an almost identical achievement (7.6). This difference in the mean achievement of the two student subsamples was not statistically significant ($t(89)=-.11$, $p=.91$). These findings suggest that previous explicit exposure during university classes to the topic of the role of hedges and boosters in RAs did not significantly affect students' success in recognizing the correct degree of the author's commitment. This piece of evidence does not support our first expectation (H1). Master's degree students were not more successful at this task.

### 5.2 Students' achievement in the sentences containing boosters vs. the sentences containing hedges

As already mentioned, the achievement in both subsamples was different in regard to the sentences containing boosters, i.e., certainty markers (more correct answers provided in both samples) versus hedges, i.e., probability and possibility markers (lower achievement). Here, we test these differences more systematically.

Table 4 shows the mean achievement for the groups of sentences containing three types of markers, in two groups of students, and the sample as a whole. The achievement was calculated as a score ranging from 0 (minimum achievement) to 1 (maximum achievement).[8] It can be noticed that students of both levels of study had the best

[8] Bearing in mind that an unequal number of sentences belonged to each category (certainty–4, probability–6, possibility–5), the achievement score was corrected for a different number of tasks per group and rescaled, i.e., expressed on a scale from 0 to 1.

achievement when assessing the degree of the author's commitment in the sentences containing the markers that belong to the category of certainty, followed by those with probability markers. Students in both subsamples found it most difficult to detect the degree of the author's commitment when a possibility marker was present, thus corroborating the findings of Takimoto (2015).

**Table 4.** Average achievement in the sentences containing three types of markers.

| | Master's students | Bachelor's students | The whole sample |
|---|---|---|---|
| Certainty | 0.73 | 0.74 | 0.73 |
| Probability | 0.55 | 0.52 | 0.53 |
| Possibility | 0.30 | 0.31 | 0.31 |

In order to compare the significance of differences in the mean levels of achievement in three types of sentences, a paired-sample test was performed in bachelor's and master's subsamples separately. Put differently, we compared all pairs of mean achievements – certainty vs. probability, certainty vs. possibility and probability vs. possibility – on two students' subsamples. All pairs of comparisons were statistically significant at the $p<.01$ level.

Bachelor's degree students had a significantly better achievement in assessing the degree of commitment in the sentences with certainty markers than in those with probability markers, $t(48)= 5.45$, $p<.01$, or those with possibility markers, $t(48)= 8.27$, $p<.01$, as well as in the sentences containing probability markers compared to those containing possibility markers, $t(48)= 4.52$, $p<.01$. In other words, bachelor's students had the best achievement at certainty sentences and the worst at possibility sentences, with probability sentences somewhere 'in between'.

The same applies to the achievement of master's students. They were much more successful in marking correctly the sentences containing certainty markers than those containing probability items, $t(41)= 3.67$, $p<.01$, or possibility items, $t(41)= 8.25$, $p<.01$, as well as the sentences with probability markers compared to those with possibility markers, $t(41)= 6.23$, $p<.01$. As in the case of bachelor's students, the level of achievement was dependent on the types of markers used in sentences – moving from certainty towards probability and possibility implied moving from the best to the worst achievement.

Paired-sampled comparisons on the sample as a whole showed the same results: students were more successful with certainty markers in comparison to both probability, $t(90)= 6.45$, $p<.01$, and possibility markers, $t(90)= 11.71$, $p<.01$. Similarly, achievement was higher in the sentences with probability as compared to the sentences with possibility markers, $t(90)= 7.35$, $p<.01$. This is in line with the findings of both Hyland's (2000) and Takimoto's studies (2015), which showed that boosters were significantly more "visible" than hedges. This finding, also, supports our second expectation (H2).

Our data offer additional insight into the nature of these differences. In the second part of the questionnaire, students were asked to state the words and expressions in each sentence, which helped them decide about the degree of the author's commitment. As mentioned previously, each answer was coded as correct or incorrect in this sense. The percentages of correct and incorrect answers in both subsamples are given in Table 5.

Overall, master's students performed well – in absolute or relative majority, they provided correct answers in 12 out of 15 sentences in total. The percentage of correct answers ranges from 71.4 % (Sentences 1 and 10) to 7.1 %. It is evident that Sentence 15, where students were supposed to recognize the hedge *potential*, was the most difficult one, since only 7.1 % of participants managed to select the word which was supposed to indicate the proper degree of commitment in the sentence. Still, in only three sentences (2, 12 and 15) the percentage of master's students who gave a wrong answer (i.e., an incorrect indicator) was higher than the percentage of those who chose the correct indicator.

**Table 5.** Selection of commitment indicators – correct and incorrect answers (in %).

| | Master's students | | Bachelor's students | |
|---|---|---|---|---|
| **Sent. No.** | *Correct indicator* | *Incorrect indicator* | *Correct indicator* | *Incorrect indicator* |
| **1** | 71.4 | 28.6 | 79.6 | 20.5 |
| **2** | 35.7 | 64.3 | 42.9 | 57.1 |
| **3** | 66.7 | 33.3 | 61.2 | 38.8 |
| **4** | 52.4 | 47.6 | 59.2 | 40.8 |
| **5** | 61.9 | 38.1 | 73.5 | 26.5 |
| **6** | 64.3 | 35.7 | 65.3 | 34.7 |
| **7** | 61.9 | 38.1 | 67.3 | 32.7 |
| **8** | 69 | 31 | 69.4 | 30.6 |
| **9** | 54.8 | 45.2 | 55.1 | 44.9 |
| **10** | 71.4 | 28.6 | 81.6 | 18.4 |
| **11** | 69 | 31 | 67.3 | 32.7 |
| **12** | 45.2 | 54.8 | 61.2 | 38.8 |
| **13** | 50 | 50 | 46.9 | 53.1 |
| **14** | 69 | 31 | 81.6 | 18.4 |
| **15** | 7.1 | 92.9 | 26.5 | 73.5 |

As for the bachelor's students, in this part of the task, the range of correct answers is from 81.6 % (the highest, in Sentences 10 and 14) to 26.5 % (the lowest), referring to the percentage of correct answers in Sentence 15, the same sentence which master's degree students also found most difficult to select the proper word in (although, compared to master's degree students, a much higher percentage of bachelor's degree students managed to provide a correct answer). Similarly to master's degree students, the absolute or relative majority of bachelor's degree students managed to provide a correct indicator

of commitment in 12 out of 15 sentences. The only three sentences where the majority of bachelor's students provided a wrong answer were sentences 2 (57 % of incorrect indicators), 13 (53 %) and 15 (73.5 %).

When we observe students' achievement on this set of questions as a whole, the range of possible correct answers in selecting the word which helped them make the assessment is again 0 to 15. Expressed that way, bachelor's students scored an average of 9.4 correct answers, while master's students' score was somewhat lower, 8.5. Still, the difference in the achievement of the students from the two groups is not statistically significant ($t(89)=.96$, $p=.34$). Thus, once again, these findings do not support our expectations regarding the 'positive' role of explicit instructions which should have resulted in better achievement of master's students. But, at the same time, the lack of significant differences in light of the previously shown exact patterns of achievement depending on the type of markers in the sentences supports the expectations that all students should be better in identifying boosters than hedges.

In order to additionally validate the (in)significance of explicit instructions during classes, we analyzed students' achievement in correctly identifying the degree of commitment in regard to accuracy when selecting the words and expressions which were the indicators of such commitment. In other words, we compared high and low achievers on each sentence by their accuracy in recognizing the adequate markers. For the sake of easier data inspection, Table 6 presents the percentages of those who correctly identified

**Table 6.** Accuracy in selecting the correct indicator of commitment in the group of students who marked the commitment statements correctly.

| Sent. No. | Bachelor's students | Master's students |
|---|---|---|
| 1 | 80 % | 0 % |
| 2 | 45 % | 41 % |
| 3 | 78 %* | 76 % |
| 4 | 66 %* | 63 % |
| 5 | 75 % | 65 % |
| 6 | 78 % | 82 %* |
| 7 | 78 %* | 79 %* |
| 8 | 67 % | 75 % |
| 9 | 56 % | 69 %* |
| 10 | 89 % | 83 % |
| 11 | 83 %* | 79 %* |
| 12 | 67 % | 50 % |
| 13 | 45 % | 65 %* |
| 14 | 87 % | 89 %* |
| 15 | 22 % | 13 % |
| Average | 68 % | 62 % |

Note: The * implies that in these cases the finding is significant at least at the $p<.05$ level.

the degree of commitment in specific sentences and managed to correctly identify the specific markers. Hence, for example, 80 % of bachelor's degree students who correctly assessed the degree of the author's commitment in Sentence 1 correctly identified the specific marker in that sentence that informed their decision. The same goes for the 45 % of those who correctly assessed the degree of author's commitment in Sentence 2 and correctly identified the specific marker. None of the master's degree students who correctly assessed the degree of the author's commitment in Sentence 1 correctly identified the specific marker etc.

In both samples, in the majority of sentences, there were no significant differences in the marker identification accuracy between low and high achievers.[9] There were some sentences where the students who had given the correct answer as to the degree of author's commitment significantly more often managed to select the correct commitment indicator (marked with an * in Table 6). This relates to four sentences in bachelor's degree students' sample (Sentences 3, 4, 7 and 11) and six sentences in master's degree students' sample (sentences 6, 7, 9, 11, 13 and 14). Still, even in these cases the relationship was relatively weak. In other words, successfulness in selecting the proper word indicating the degree of author's commitment did not depend on whether students had been able to correctly infer the degree of commitment in that particular sentence in the first part of the task. Also, it seems that the pattern is quite similar in two student subsamples, further possibly demonstrating the lack of significant 'effect' of instruction that master's degree students had experienced. The average level of 'successfulness' in two subsamples is quite similar as well (68 % versus 62 %, respectively).

### 5.3 Assessment of the degree of the author's commitment – the role of language proficiency

Bearing in mind the results of previous studies which showed that students' English proficiency may play an important role in the ability to recognize and use hedging and boosting devices, we explore the relationship between the students' level of proficiency and their successfulness in marking the commitment statements and providing the words serving as commitment indicators. In the group of bachelor's degree students, the correlation analysis indicates that those who have a higher level of knowledge of the English language had a better achievement in marking correctly the author's degree of commitment and *vice versa* ($r$=.45, $p$<.01). The correlation between the level of knowledge of English and successfulness in selecting the right words, i.e., marker identification accuracy, is also significant and positive; i.e., in the group of bachelor's degree participants, higher levels of knowledge are accompanied by a better achievement on this set of questions ($r$=.46, $p$<.01). Hence, overall, at the bachelor's degree student's level, being more proficient in English is related to better achievement in both types of tasks.

[9] The percentages of low achievers who correctly identified markers are not shown in Table 6; the chi-square test was used for comparisons.

In the group of master's degree students, the relationship between the level of knowledge and achievement in marking the commitment correctly is not statistically significant ($r$=.15, $p$=.36), but the achievement in selecting the proper indicator of commitment is significantly and positively related to the level of knowledge ($r$=.33, $p$<.05). This implies that master's degree students who have a higher level of knowledge of English were more successful in one task only, i.e., in selecting the right commitment indicators.

As a matter of fact, language proficiency proved to be far more important for achievement than the level of study. A two-way analysis of variance (ANOVA), with the level of study and language proficiency (recoded into three levels: A, B, and C) as factors and the achievement in marking correctly the author's degree of commitment as a dependent variable, showed that there was no significant main effect of the level of study ($F$[1,85]= .15, $p$=.69) and their interaction term ($F$[2,85]= .25, $p$=.77); language proficiency's main effects were marginally significant ($F$[2,85]= 2.71, $p$<.07). As shown in Figure 1, there were prominent differences in the mean achievement level between the students with different language proficiency both among the bachelor's and master's degree students. On the other hand, the differences between these two groups of students at the same level of language proficiency skills were almost absent.[10]

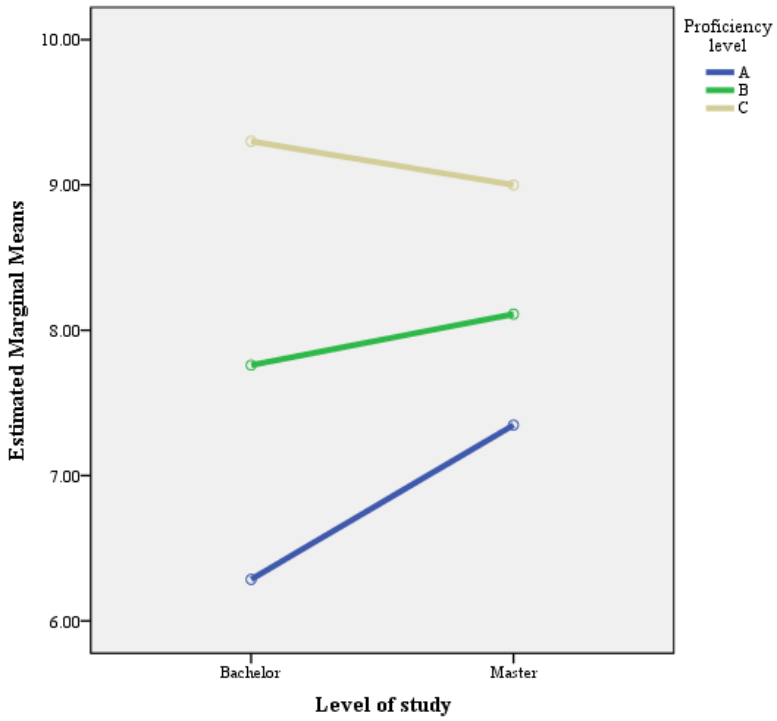


**Figure 1.** Mean achievement in assessing correctly the author's degree of commitment by the level of study and language proficiency.

[10] It is interesting to note that the differences between three proficiency levels among bachelor's students were more prominent than among master's students; this could indicate that explicit instruction received on the notion and role of hedging and boosting devices in the group of master's degree students makes language proficiency *less* relevant, i.e., that instructions do make a difference, but these trends are only illustrative.

Similar results were obtained in the two-way ANOVA with the level of study and language proficiency as factors and the achievement in selecting the proper indicator of commitment, i.e., marker identification accuracy, as dependent variables (Figure 2). Once again, the only significant effect was the main effect of language proficiency ($F$[2,85]= 7.25, $p$<.01), while its effects among students at the two levels of study were even more prominent. Among both the bachelor's and master's degree students, those with higher language proficiency were far more successful in marker identification accuracy tasks than those with lower proficiency levels. Likewise, the differences between bachelor's and master's degree students at the same level of language proficiency were not registered, implying that the level of achievement was far more affected by the level of language proficiency than the level of study.

All said, the presented data strongly support the expectations regarding the relevance of language proficiency in students' achievement in the given tasks (H3).

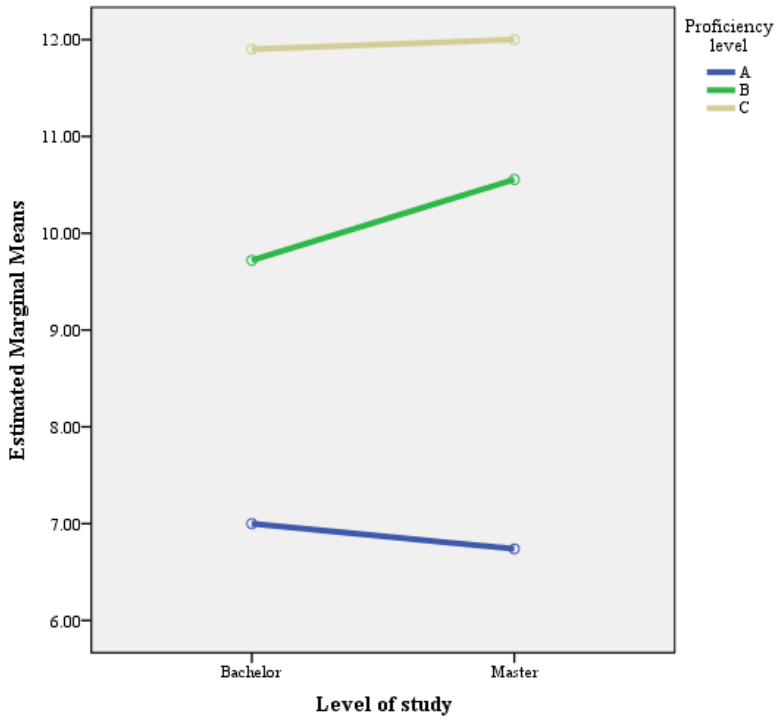


**Figure 2.** Mean achievement in selecting the proper indicator of commitment by the level of study and language proficiency.

### 5.4 Qualitative analysis of incorrect answers in the task of selection of the proper commitment indicator

In this final part of the results section, we briefly focus on the qualitative analysis of the incorrect answers of study participants of both levels of study in the items where they were asked to state the indicator of author's commitment in the particular sentences. Table 5 shown above indicates that successfulness of participants in identifying the word(s) which reflected the degree of the author's commitment varied depending on the sentence.

In Hyland's study (2000, p. 184), it was shown that participants mostly based their decisions about the level of the author's commitment on the propositional elements of the sentence instead of relying on target items. Based on our analysis of incorrect answers, the same can be said for this study. Both master's and bachelor's degree students who failed to identify true commitment markers typically opted for some lexical words or more often the whole structures which are the proposition content holders. There are also some illustrative patterns revealed in the data via qualitative analysis.

First of all, in almost every sentence, participants thought the lexical words specifically related to agriculture were commitment indicators, such as *predatory arthropods*, *cotton canopies*, *predators* (Sent. 1), *pests* (Sents. 3, 9), *yield*, *small-holder farms* (Sent. 6), *canopy* (Sent. 7), *oilseed rape and cereals*, *lipid rich seed* (Sent. 8), *vermicompost extract* (Sent. 9), *ZT seeding* (Sent. 10), *compost* (Sent. 11), *crop residue* (Sent. 12), *weevil*, *beneficial populations*, *malathion*, *species* (Sent. 13), *coffee leafminer* (Sent. 14), *pesticides* (Sent. 15). They also (incorrectly) stated different lexical verbs, such as *to suppress* (Sents. 1, 13), *to result in* (Sent. 5), *to include* (Sent. 7), *to use* (Sent. 7), or *to assess* (Sent. 15). They also stated nouns such as *variety* (Sents. 2, 5), *plants*, *experimental cages* (Sent. 3), *amount* (Sent. 5), *difference* (Sent. 8), *eradication* (Sent. 13), as well as some specific nouns which belong to scientific vocabulary, e.g. *these studies* (Sent. 4), *assessment* (Sent. 6), *these results* (Sent. 9), *current study* (Sent. 11), *inputs* (Sent. 12), *these factors* (Sent. 14), *our research* (Sent. 15). Finally, in some cases, students also stated adverbs and adjectives, e.g., *significant* (Sent. 2), *significantly* (Sents. 3, 4, 10), *large-scale* (Sent. 4), *only (six papers)* (Sent. 7). These findings indicate that a large number of participants failed to identify the wanted markers and understand their pragmatic roles due to misunderstanding or they did not understand these words' meanings properly and their respective functions in the context. In line with Hyland (2000), both bachelor's and master's degree students did not manage to identify verb *to suggest* as a hedge, which is somewhat contrary to the findings of Vesić Pavlović and Đorđević (2020a) where students employed more hedges than boosters when writing essays in English. All this could imply that students might benefit from clearer guidance and instructions in differentiating two sorts of markers or special focus on hedges, as typically proved harder to grasp.

## 6. Discussion and conclusion

Relying on previous research in the field, the aim of our study was to explore the extent to which ESP students were able to distinguish the authors' commitment towards a claim on the continuum from uncertainty to certainty in the examples of academic writing. The sample of study participants included two groups of students of the Faculty of Agriculture, University of Belgrade, studying at the bachelor's and master's degree levels, who differed with regard to their previous exposure to the concept of the use of MD markers during their university courses of English. Students filled in the questionnaire designed for the purposes of the study, in which they first assessed the author's degree of commitment on the continuum comprising certainty, probability and possibility in 15 sentences, and then stated the words/expressions in each sentence that served as an indicator of such a level of the author's commitment.

Study results point to three important findings. First of all, the findings indicate that previous input during ESP classes regarding the use of MD markers did not significantly affect students' success in recognizing the correct degree of the author's commitment or their achievement in correctly selecting the words which were supposed to indicate such commitment, contrary to our first hypothesis. Second of all, as expected in H2, students of both levels of studies had most success when assessing the degree of the author's commitment in the sentences expressing certainty, i.e., those with boosters, and the least success with those sentences that expressed possibility. Finally, the factor which did affect achievement was the student's level of language proficiency, in the bachelor's students' sample both in selecting the proper degree of commitment and selecting the words serving as its indicators, and in the master's students, it affected the success in selecting the right words, supporting our third hypothesis.

This study corroborated the findings of previous studies conducted by Low (1996), Hyland (2000) and Takimoto (2015) that learners of English are better at noticing boosters than hedges in academic writing. Likewise, there is no doubt about the crucial importance of language proficiency in managing these rhetorical devices. The findings of this survey unequivocally support it. With that in mind, we can hypothesize that a higher level of understanding the pragmatic role of boosters and hedges, and consequently, higher successfulness in being able to recognize them in academic writing, may come from a sort of 'unfocused' efforts in promoting language proficiency *per se* or in general. It seems that explicit instructions, at best, can ameliorate the proficiency 'effects', as visible by indicative (though non-significant) trends in greater differences between students with different language proficiency at the bachelor's level. Still, it cannot compensate for the lack of language proficiency. Above all, the relevance of language proficiency might be an important methodological issue since, as already stated, it can affect not just the successfulness of assessing the boosters and hedges but the nature of the language task a student with, say, poor language skills is presented with.

Another factor that should be taken into account when interpreting the results is the factor of a specific culture, i.e. the fact that students' ability to detect boosters more easily than hedges may be attributed to cultural differences, and native language transfer. In Serbian culture, directness and clarity are highly valued, possibly leading students to instinctively recognize and grasp language elements that convey certainty or emphasis, such as boosters. Additionally, native language may play a role in this, as students tend to identify patterns and structures in their native language and apply them when learning a new language. If their mother tongue has similarities with the target language in terms of the boosting elements, students will be more likely to detect and comprehend boosters with ease. Conversely, the subtleties of hedges, which involve cautious language and uncertainty markers, might be more challenging for students to grasp, especially if these features are less prevalent or distinct in their native language as is the case in Serbian. Understanding these cultural and linguistic factors can enhance language teaching strategies, allowing teachers to tailor their approach and support students in mastering both boosters and hedges effectively.

All said, this study bears relevance since it shows the extent to which Serbian agriculture bachelor's and master's degree students are aware of boosters and hedges used in sentences extracted from RAs, as well as of their pragmatic functions within academic contexts. These findings add to the overall picture related to non-native English students' awareness of and ability to identify boosters and hedges in academic writing, implying their importance in both instruction and practical usage within academic writing. The limitation of the study is a relatively small sample of students of one faculty only. Thus, studies of this kind could be broadened to include students of other and diverse disciplines and larger groups of students. Further, the study should be conducted on more balanced samples in terms of language proficiency, as well as on a larger sample of sentences. Similarly, combining different methods (e.g. studies with a mixed method design) and using different sources of materials in a single study (e.g. a quantitative survey, knowledge-based tests, freely produced essays) could only help improve our understanding of this phenomenon. It would also be beneficial to address one inherent issue by analyzing understanding and use of MD markers in those learners who have generally low language proficiency and, possibly, by formulating more sensitive test materials, which would help overcome the effect of low proficiency effects.

As for the study material, students were supposed to infer the degree of the author's commitment in isolated sentences, while it might have been helpful to include the broader context of the whole text in which they were originally found. Future studies should address these issues as well. Finally, although such an assumption seems fully justified, it must be stated that the differences in the level of study were treated as a difference in explicit instructions on the use of MD markers since master's degree students did receive instructions regarding MD markers and bachelor's degree students did not. Still, we must not lose sight of another 'fact' – being in a position to be instructed about something does not necessarily imply being truly instructed. In other words, we know that master's degree students were taught about the concept and use of MD markers, but it was not checked

what they had actually learned with this respect. Hence, future research could address this issue by taking into account the differences in the level of acquisition of the curriculum, by, for example, analyzing the relevance of the grades obtained in the English language course at the faculty. These would, of course, include only master's degree students, but it would further test the conclusions made in this study.

Since students had more difficulty recognizing hedges compared to boosters, it is necessary to design specific instructional activities that focus on teaching students about hedges. Teachers can create exercises and examples that highlight various forms of hedges used in academic writing, such as modal verbs, tentative language, or qualifiers. In addition, explicit teaching strategies that directly address the identification of hedges in texts should be implemented. This could involve providing clear definitions, offering diverse examples, and engaging students in interactive activities where they practice identifying hedges in real-world texts.

Furthermore, students should be instructed to understand how the use of these linguistic markers can influence the overall tone, credibility, and persuasiveness of a text. Students should be encouraged to question and analyze the author's certainty and to consider the implications of different degrees of certainty on the information presented. By incorporating these pedagogical strategies, teachers can help students develop a nuanced understanding of hedges and boosters, thereby improving their critical reading skills and ability to evaluate the certainty of authors in academic texts.

In conclusion, although these findings suggest that prior instruction and input related to hedging and boosting devices did not have much influence on students' achievement related to identifying these devices in the academic context, we argue that it is important to integrate boosters and hedges when teaching university English courses, especially when it comes to academic writing. This particularly applies to those students who strive to pursue their future careers in an academic environment. Bearing the study results in mind, additional efforts need to be undertaken to better tailor the instruction that students of different levels of proficiency receive or apply different methods in instructing them. We should think of different assignments that could help students master this pragmatic competence along with boosting their level of proficiency. Diverse strategies should be employed when introducing and teaching these devices. In other words, emphasis should be focused on their productive usage apart from their identification in different contexts.

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# Appendix 1

## List of sentences

1. The results suggest that outbreaks of *S. exigua* and other lepidopteran pest outbreaks in cotton are mostly supressed by the ecology of predatory arthropods in the cotton canopies as opposed to one or a few main predators.
2. Three studies that had substantial yield variations between the N treatments were integrated for analysis, which showed a significant interaction between N levels and variety for yield.
3. Firstly, it seems that all application rates of the aqueous extracts rendered both tomatoes and cucumbers significantly less attractive to all three pest species since all three pests examined in the experimental cages were free to infest the test plants.
4. These studies demonstrate that repeated large-scale applications of malathion ULV within the Texas boll weevil eradication program significantly reduced the seasonal numbers of the majority of predators operating in the cotton plant canopies.
5. It appeared that the small amount of remobilised stem nitrogen which led to the maximum stem N concentration at maturation of any of the varieties at 27.9 kg/ha compared to the lowest at 18.5 kg N/ha for Royal resulted in the low N harvest index of NK Bravour.
6. Assessments of potential influence may consider just economic yield, or they may examine plant characteristics, resource consumption, environmental factors, or socio-economic evaluations, which might extend to forecasts of regional food security and the long-term viability of small-holder farms.
7. A crop model that clearly included the effects of $CO_2$ on canopy temperature was used in only six papers.
8. The difference between oilseed rape and cereals can be partly explained by the situation that 45 % more assimilate is needed to generate each kilogram of lipid rich seed compared with starch rich wheat or barley seed.
9. These results raise the question of possible methods by which these soil drenches containing vermicompost extract may affect how pests react when absorbed by plants.
10. This was probably due to a significantly lower plant number of ZT seeding than the other methods as reported in 2001.
11. Since there was no yield response to compost in the current study, an essential validation data set for DSSAT modeling was obviously removed.

12. It has been assumed that the additional C in the three FPOOLs is in the proportions of 0.2:0.7:0.1 for crop residue and root inputs.
13. It is thought that beneficial insect populations that suppress the populations of pest species decline as a result of area-wide and repeated applications of malathion ULV during the eradication of the boll weevil.
14. Presumably, these factors had an indirect impact on the abundance of coffee leafminer by lowering the numbers of its natural enemies.
15. Our research did not assess the potential sublethal and long-term non-target impacts of the pesticides.