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Transition markers in Qatari university students' argumentative writing: A cross-linguistic analysis of L1 Arabic and L2 English

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ABSTRACT

The current cross-linguistic study compares university students' use of transition markers (addition, compare/contrast, and consequence markers) in their L1 Arabic and L2 English argumentative writing. It also explores students' metalinguistic understanding of transition markers (TMs) through writing conversation interviews. We analysed the Qatari Corpus of Argumentative Writing (QCAW), which comprises 390 texts in L1 Arabic and L2 English written by the same Qatari undergraduate students. Using Hyland's (2005) model of metadiscourse, the findings revealed that frequencies of transition marker use among less proficient L2 English writers were closer to L1 Arabic. Based on the results of a writing proficiency test, low-proficiency students transferred overt strategies to signal transitions, supported by the interview findings. Interestingly, students with an average L2 English proficiency exhibited a greater variety in TMs. In contrast, higher-proficiency writers tended to use more complex and subtler means to indicate textual transitions. The students used TMs for different purposes. Lack of knowledge and writing under controlled conditions inhibited some participants from using TMs. The paper concludes with pedagogical implications for teaching and assessing TMs.

1. Introduction

1.1. Transition marker use in L2 English academic writing

Transition markers (TMs) are varyingly referred to as discourse markers (Hyland, 2005; Maschler and Schiffrin, 2015), linking adverbials (Biber et al., 2021; Peacock, 2010), discourse connectives (Danlos et al., 2018), internal conjunctions (Gardezi and Nesi, 2009; Han and Gardner, 2021), and logical markers (Mur Duenas, 2009). They constitute metadiscoursal words or phrases whose function is to indicate some logical relationship between two or more clauses, sentences or longer stretches of discourse (Celce-Murcia and Larsen-Freeman, 1983, Hyland and Tse, 2004). Research shows TMs are numerous compared with other metadiscourse devices (Hyland, 2005; Han and Gardner, 2021; Intaraprawat and Steffensen, 1995; Lee and Casal, 2014; Li and Wharton, 2012), guiding readers of academic texts by clarifying the sequence of ideas (Intarpaprawat and Steffensen, 1995), distinguishing new information from old, paving the way for opposing views to be presented, juxtaposing and adjudicating contrasting views (Kuzborska and Soden, 2018), transferring ideas at the sentence and paragraph levels (Poudel and Dhankuta, 2018), and indicating a summary or a conclusion is to be presented (Alice et al., 2019). Transition Markers are important for better quality writing by enhancing text cohesion (Cao and Hu, 2014), leading readers to interpret meaning purposefully (Blakemore, 2002) and functioning ideationally by signalling how the writer logically relates different ideas (Hyland and Tse, 2004).

Intersecting propositional content at both sentence and discourse levels, transitions are one of the most difficult types of metadiscourse markers for L2 students of English to master in academic writing (Ahmed, 2010b; Al-Jarf, 2001; Granger and Tyson, 1996; Intaraprawat and Steffensen, 1995; Jones, 2011; Khalil, 1989; Kuzborska and Soden, 2018 Modhish, 2012; Sadighi, 2012; Walková, 2020). Evidence from contrastive rhetoric research shows that L2 writers of varying L1 backgrounds and L2 English proficiency levels overuse TMs relative to both novice (Ädel, 2006; Basturkmen and von Randow, 2014; Mestre-Mestre, 2017) and expert native speakers (NSs) (Bahrami, 2012; Burneikaitė, 2008; Hinkel, 2001; Lei, 2012). Less proficient L2 writers have been found to exhibit overdependence on a narrow range of syntactically simple TMs (e.g., 'and', 'but', 'so') (Ho and Li, 2018; Kennedy et al., 2001; Kojima et al., 2019; Lei, 2012), perhaps because such items

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provide a sense of security to writers (Hasselgren, 1994; Kuzborska and Soden, 2018). Additional forms reported in the literature as being overused include adding points to an argument (Granger and Tyson, 1996; Ho and Li, 2018; Kojima et al., 2019), particularly in the sentence-initial position (Milton, 2001) and the adversative forms, 'besides' (Lee & Chen, 2021), 'however' (Aull and Lancaster, 2014; Bolton et al., 2002), and 'on the other hand' (Han and Gardner, 2021), although there is not complete agreement in the literature (Han and Gardner, 2021; Hinkel, 2001).

Aside from limitations in students' language proficiency repertoires, developing writers' overreliance on TMs is often attributed to the linguistic and cultural artefacts that transfer from L1 (Bahrami, 2012), with researchers drawing on Kaplan's influential theory of cultural thought patterns. Additionally, developmental, educational, and students' personal experiences and writing strategies are reported to be other factors raising the level of challenge for developing L2 writers (Liu, 2011). Overuse is also associated with an overt strategy to construct a unified surface-level flow of ideas in the absence of a sufficient syntactic and lexical range (Hinkel, 2001; Lei, 2012), rote learning (Kennedy et al., 2001) or even as the outcome of explicit academic writing instruction (Burneikaitė, 2008; Intaraprawat and Steffensen, 1995). Transition marker overuse varyingly results in artificial and mechanical prose (Zamel, 1983), with some devices coming across as redundant (Basturkmen and von Randow, 2014; Milton and Tsang, 1993) or being perceived as an attempt to disguise poor writing (Lei, 2012). Regrettably, metadiscourse research tends to neglect the learner as an informant, who could conceivably offer profound explanations and rationales for the forms they employ in L2 English academic writing by querying individuals' metalinguistic understanding.

1.1.1. Underuse of transition markers in L2 English academic writing

Some studies have revealed that developing L2 writers underuse TMs relative to L1 users and professional writers of native and non-native backgrounds (Altenberg and Tapper, 1998; Kuzborska and Soden, 2018; Lei, 2012). One category of markers that has been known to cause difficulties, resulting in their frequent omission, are adversatives (e.g., 'in spite of this', 'on the contrary', 'alternatively') (Granger and Tyson, 1996; Hinkel, 2001; Lee and Chen, 2009; Lei, 2012), indicating many L2 writers have difficulty changing the direction of an argument in academic writing (Granger and Tyson, 1996) and adjudicating between contrasting perspectives (Kuzborska and Soden, 2018), possess a reticence to use linking adverbials associated with formal registers (Altenberg and Tapper, 1998; Granger and Tyson, 1996) or, as is commonplace, lack awareness of and experience with manipulating such forms (Hinkel, 2001; Lei, 2012; Li and Wharton, 2012). Additionally, it has been reported that L2 student writers struggle to move arguments forward logically using connectives of consequence/implication (Granados and Lorenzo, 2021, Granger and Tyson, 1996). Since few studies have consulted learners themselves, it is possible that these trends may be 'natural' relative to professional academic writers, who invariably need to use longer, more complex sentences (Takač and Ivezić, 2019).

Consequently, a complex research picture emerges where learners are reported to over and underuse categories of TMs and individual devices themselves (Altenberg and Tapper, 1998; Granger and Tyson, 1996; Kuzborska and Soden, 2018; Takač and Ivezić, 2019). One reason for this inconsistency is that writer and textual characteristics are widely known to mediate metadiscourse use. Differences in the registers of written texts, conditions of writing, the teacher support provided, learners' L1, educational backgrounds, and academic attributes (e.g., aptitude, motivation, beliefs) make comparison across studies very difficult. At the same time, some authors have questioned the validity of comparing L2 developing writers' texts with those by expert L1 writers (often the research article as the prototypical textual genre) (e.g., Connor and Moreno, 2018; MacKenzie, 2015). They highlight that the notable differences in discourse expectations, writers' purposes, and language resources mean variations in transition marker use are not unexpected. Additionally, metadiscourse use in English as a lingua franca need not resemble English as a native language (MacKenzie, 2015), while successful L1 writers make stylistic choices that not all readers agree with (Han and Gardner, 2021). As such, some authors have opted to compare TM use across L2 English proficiency levels only rather than with L1 English (e.g., Bax et al., 2019; Carrio-Pastor, 2013; Intaraprawat and Steffensen, 1995).

Another reason for the contradictory results in the overuse and underuse of TMs in some studies is that methodological inconsistencies directly influence the validity and comparability of the results (Walková, 2020). Several previous studies researched TMs in smaller data groups (Bolton et al., 2002; Burneikaitė, 2008; Carrio-Pastor, 2013; Chen, 2006; Intaraprawat and Steffensen, 1995; Lei, 2012; Noble, 2010), resulting in more idiosyncratic findings. Procedurally, there might have been a problem in accurately identifying TMs by investigating other metadiscourse categories with TMs (Gao, 2016; Lei, 2012), which may have affected the detected overuse of TMs (Bolton et al., 2002). Moreover, another problematic element is the accuracy of measuring the overuse and underuse of TMs, which is affected by the selection of frequency calculation methods (Chen, 2006). The frequency of TMs in corpora is calculated per number of words, although this method neglects the length of TMs, which may be between one and four words (Hyland, 2017). Few studies that have analysed how L2 English students use TMs explicitly controlled for writer language proficiency (Altenberg and Tapper, 1998; Granger and Tyson, 1996), a contextual characteristic that mediates metadiscourse marker use.

1.1.2. Other conceptions of metadiscourse marker misuse in L2 English academic writing

Researchers have varyingly operationalised misuse of TMs with regard to their effect on the reader. Issues that can impact the communication of meaning include the misleading use of connectors, in other words, where the transition device does not cohere with the relationship between the propositional content that the writer is seeking to convey (Intaraprawat and Steffensen, 1995; Milton and Tsang, 1993), the omission of a device confusing the reader in the form of a sentence fragment (Anwardeen et al., 2013; Kojima et al., 2019), and the association between excessive use of devices and run-on sentences (Dobbs, 2014; Kojima et al., 2019; Qin and Uccelli, 2019). Less impactful on meaning, albeit harmful for writer credibility, is the repetition of (a narrow repertoire) of TMs. Unsurprisingly, research has found that more proficient writers consistently use a greater variety of TMs than lower-ability ones (Bax et al., 2019; Intaraprawat and Steffensen, 1995; Noble, 2010), indicating that a range of forms and functions are crucial to successful academic writing. Other, more mechanical issues of note include errors in the syntactic form of markers ('in one hand') and the absence of punctuation after some sentence-initial items ('In conclusion nowadays people should cycle to work') (Gholami et al., 2014).

1.2. L1 Arabic learners' use of transition markers

Despite constituting the world's sixth most popularly spoken language, there are remarkably few studies examining the role of TMs in mediating the writer-reader interaction in the context of Arabic, and virtually none in top-tier academic publications. The existing nascent body of literature encompasses a few inquiries investigating how L1 Arabic users incorporate TMs into their L2 English academic texts in comparison with L1 English speakers (Hinkel, 2001; Modhish, 2012) and a larger body of work contrasting TM use in professional Arabic and English writing (e.g., Alotaibi, 2015; Hussein et al., 2018; Sultan, 2011), with notable implications for L1 transfer. Neither study type has comprehensively highlighted usage patterns of individual markers in English and Arabic. The findings of former studies indicate that some students tend to overuse TMs in English, particularly coordinating conjunctions, 'a', 'so', and 'but'. Hinkel's (2001) quantitative analysis of

cohesive devices in the academic texts of native and non-native speakers indicated that Arabic speakers employed sentence transitions at significantly higher median frequency rates than NS (and L1 Japanese, Korean, and Indonesian speakers). Sentence transitions were also more prevalent among Arabic users compared with NS. However, they were less than in the other three cohorts. Similar to previous studies, the L1 Arabic style of composition was one of the reported socio-cultural issues that negatively impacted students' writing in L2 English (Ahmed and Myhill, 2016).

Researching in a Yemeni tertiary context, Modhish (2012) investigated the usage frequency of a range of metadiscourse markers on discursive essays, finding that L1 Arabic writers employed a limited range of cohesive devices, suggesting that such markers were not considered an essential element of university writing courses. As with Hinkel (2001), an overreliance on simplistic coordinating conjunctions was found. One notable explanation present in the growing body of research contrasting Arabic professional writing with English indicates that a high density of transitions is characteristic of written Arabic (Hussein et al., 2018; Khalil, 1989; Sultan, 2011), pointing to the transfer of L1 TM orthodoxies to L2 English. Such a feature could prove problematic for students seeking to adhere to disciplinary-specific conventions in English. Mirroring other learner L1s, Arabic-speaking students become sensitised to the role of TMs in guiding the reader in processing and understanding their intended message in L2 English. Yet, to the best of our knowledge, no research has addressed the mediating role of L2 English proficiency on the usage of TMs by L1 Arabic users nor compared use in students' L2 with their Arabic L1. In light of these uncertainties, we echo calls from prior researchers that research is needed to investigate patterns of use and the appropriacy of transition marker usage across L2 English written by L1 Arabic users (Ahmed, 2010a; Al-Rubaye, 2015; Alshahrani, 2015; Appel, 2020; Appel and Szeib, 2018; Modhish, 2012). Crucially, to develop our understanding of the factors that influence the frequency and variety of TMs in L2 English academic writing (Walková, 2020), it is essential to solicit the perspectives of developing writers, who are seldom granted a voice in metadiscourse research.

1.3. Research questions

The following research questions guided the design of the present study:

1. What is the difference (if any) in the frequency and variation of transition markers used by L1 Arabic and L2 English university students of different proficiency levels?
2. How do university students metalinguistically understand transition markers in their L1 Arabic and L2 English argumentative writing?

2. Methods

2.1. Corpus design and data collection

The Qatari Corpus of Argumentative Writing (QCAW) (Ahmed et al., 2022) comprises 390 essays (about 500 words; in total, approximately 195,000 tokens): 195 written in Arabic and 195 written in English by the same students enrolled in various tertiary programmes at Qatar University (QU), a public research university in the State of Qatar. A few essays were excluded from the corpus as they did not reach a threshold of 250 words, chosen to avoid having inflated values from very short argumentative essays. A breakdown of the corpus is presented in Table 1. The QCAW was built to investigate the argumentative texts written by the same L1 Arabic and L2 English Qatari university students. Students produced these texts under controlled conditions: 50 minutes to write each text without reference to external input sources. Students were free to handwrite their texts, which were digitised later, or type them on their computers. Students' essays were assessed for writing quality using a standardised rubric, based on which texts were classified as high, average and low L2 English language proficiency. While written Arabic proficiency was also rated, in this study, we report the findings for TM use in L1 Arabic for the cohort. Four bilingual raters working as lecturers at the university assessed students' writing to ensure marking reliability. Table 2 below shows the raters' assessment of students' texts in L2 English. We did not use a proficiency test. Rather, we used students' produced text for the corpus to classify students into high, average and low proficiency.

Table 1
Arabic and English corpora make-up.

Corpus	# Texts	Average Essay Length	SD	Essay Length Range	Tokens
Arabic Texts	195	498.71	84.56	251–808	97,248
English Texts	195	504.51	94.87	263–1158	98,379

2.2. Writing conversation interviews

The present study used writing conversation interviews to address the second research question. These interviews, referred to as discourse-based (Lillis, 2009) or "writing conversations" (Myhill et al., 2016), focused on a text or section of a text. They aimed to gain insight into students' understanding of metadiscourse markers in their writing. Forty-one students from the learner corpus participated in the interviews, which were conducted twice - once for their English written arguments and once for their Arabic written arguments. The main emphasis was eliciting students' metalinguistic understanding of TMs (see Appendix A). The interviews were analysed using NVivo, focusing on the inductive coding of transition markers.

2.3. Participants

Participants were undergraduate students majoring in English and non-English programmes, aged 18–22 years, and of mixed gender. Thirty-six male participants and 159 females participated in the current study due to the 1–3 student ratio at the university. All participants were bilingual (i.e., L1 Arabic and L2 English). Participating students studied a core curriculum compulsory seminar course for undergraduate students from diverse disciplines. The course focused on developing students' critical reading, writing, research and academic success skills. The course assignment involved producing a well-structured argumentative essay of no less than 250 words following the typical five-paragraph format with a clearly-stated thesis statement, sound arguments and evidence to support the thesis statement, and a conclusion (Assignment Descriptor, 2017). This evaluative and argumentative writing assessment needs to be developed in response to a critical reading assignment in which the student's ability to write analytically and argumentatively is emphasised, as reflected in the grading rubric. Each participant wrote one essay in Arabic and one in English on one of two different topics (see Appendix B for writing topics in Arabic and English and their prompts). Education at QU is segregated, and instructors are assigned to teach either female or male participants.

Guided by British Educational Research Association (2018) guidelines, ethical approval certificates were obtained, and participants voluntarily signed informed consent forms. They were informed of their rights to confidentiality, privacy, anonymity, and to withdraw from the study. Students' texts were anonymised using numbers and letters for their respective languages (e.g., 112A for Arabic and 112E for English).

2.4. Data annotation and analysis

We adopted a semi-automatic corpus annotation approach assisted

Table 2
Raters' assessment of students' texts in L2 English.

Rating of Students' English Texts	Intro	Main Ideas	Critical Response	Supporting Evidence	Conclusion	Total (out of 10)	High Proficiency Students	Average Proficiency Students	Low Proficiency Students
Minimum	0.00	0.50	0.50	0.50	0.00	2.00			
Maximum	1.00	2.00	4.00	2.00	1.00	10.00			
Mean	0.50	1.39	2.12	1.52	0.48	6.01	23	147	25
Standard Deviation	0.13	0.32	0.77	0.30	0.18	1.31			

by manual validation to identify TMs in students' L2 English texts. Before analysis, we corrected all spelling mistakes to ensure we could capture our intended transition makers in DocuScope Global Version 1.8.4. American English Spelling was standardised as it was the common spelling used in most of the collected texts. Headings and titles were excluded from the analysis to avoid the repetition of task instructions.

To develop the initial taxonomy, we not only drew on Hyland's (2005) inventory of metadiscourse markers, but we also consulted studies of student argumentative writing which were similar to our tasks in being largely experience-rather than source-based (e.g., Hong & Cao, 2014; Kuzborska and Soden, 2018). We also consulted studies that focused on argumentative writing in English (Aull and Lancaster, 2014; Yoon, 2017; Yoon and Römer, 2020), cross-linguistic studies in line with our own (Lee and Casal, 2014; Candarli et al., 2015), and more broadly, analytical tools for student writing e.g., the analysis of metadiscourse via The Text Inspector is informed by Hyland's (2005) initial work (Text Inspector, 2020). We created an Arabic dictionary of TMs by translating the English markers, checking translations using dictionaries, and consulting the study of conjunctive markers by Alasmri and Kruger (2018). A final list of English and Arabic TMs can be found in Table 3.

We then used DocuScope to search for the two inventories of terms in their respective texts, manually sifting through the occurrences to determine whether the marker performed a metadiscursive transition function and, if so, establishing whether this encompassed the function of addition, comparison/contrast, or consequence. This accuracy check allowed us to develop our understanding of cases in the texts where the search terms may have belonged to more than one metadiscursive category, i.e., be 'multifunctional' or where terms were wrongly allocated metadiscourse tag completely. Discussions around these cases were informed by Crismore et al. (1993) and Ädel (2006), who discuss coding the 'primary' function of the metadiscursive unit.

We employed concordance analysis to supplement findings supported by corpus data in this study to provide helpful insights. This method is supported by Stubbs (1994), who emphasised "the need to combine the analysis of large-scale patterns across long texts with the detailed study of concordance lines" (p. 212). In this study, a close examination of sorted concordance lines started with reviewing frequencies and emerging significant TMs in Arabic and English. It provided us with the features of a marker in its immediate co-text, and concordance lines can be expanded up to the whole text when necessary. Concordance analysis considers the context of each transition marker we are aware of and leads to what can be inferred from the co-text.

AntConc (Anthony, 2022) was used to generate concordance lines for all transition markers. For example, concordance lines of "moreover" were produced by AntConc (4.0.5.), as shown in Fig. 1 below.

To maintain rigorous coding, we classified TMs by working in pairs of coders. Each pair worked on a respective corpus, with coder one and coder two annotating the corpus separately and then coming together to compare coding. First, the raters coded a small sample of five texts to trial the inventory and obtain a feel for applying the theoretical definitions of the metadiscourse categories from the seminal literature. The ratings for these five texts were then compared, and areas of disagreement were highlighted. From this, fuzzy cases of disagreement were discussed and resolved, sometimes by consulting guiding works in the literature (where available). After discussing disagreements, both raters went on to rate the remaining texts. Further disagreements within the remaining texts were also discussed.

Notably, many TMs in Arabic are equivalent to a single transition marker in English. For example, 'additionally' as an addition marker in English is expressed in Arabic writing using the following three Arabic equivalents:

إضافة إلى – علاوة على ذلك – بالإضافة إلى ذلك.

Therefore, we calculated the frequency of these markers and added them together to get the equivalent of the English marker with the same semantic and syntactic functions. Frequency counts are normalised to per 1000 words to enable comparison across the four sub-corpora.

3. Findings

3.1. Patterns of use across categories of transition markers

Table 3 summarises the descriptive statistics for the overall frequencies of the three types of TMs across the four sub-corpora. Sixty-two discrete transitions of addition, compare and contrast, and consequence were identified across the L2 English sub-corpora, while 32 translated equivalents were evident in the L2 Arabic texts. It was found that both the absolute (2,652) and normalised (27.75 per 10,000 words) frequencies of TMs students used in their L1 Arabic writing were higher than in L2 English (2449 and 24.71, respectively). Although substantially lower, frequencies of use among less proficient L2 English writers (27.44) were closer to L1 Arabic, indicating that weaker students were more dependent on overt devices to signal transitions, perhaps indicative of learned behaviour or a rhetorical tendency transferred from their L1. In contrast, more competent L2 English writers exhibited noticeably fewer transitions (21.74), a pattern that suggests such students adopted more sophisticated/less mechanical approaches to moving between propositional content.

Across both L1 Arabic and L2 English argumentative texts, addition devices constituted the most frequently occurring category of transition marker. In L1 Arabic writing, where the three categories were more

Table 3
Frequencies and proportions of transition marker categories across L1 Arabic and L2 English (according to proficiency level).

Categories of transition markers	L1 Arabic		L2 English					
			Higher proficiency		Average proficiency		Higher proficiency	
	Raw (normed)	%	Raw (normed)	%	Raw (normed)	%	Raw (normed)	%
Addition	1124 (11.76)	42.38	108 (8.54)	39.27	687 (9.20)	36.77	118 (10.58)	38.56
Compare/contrast	653 (6.83)	24.62	84 (6.64)	30.54	567 (7.57)	30.35	106 (9.51)	34.64
Consequence	875 (9.15)	32.99	83 (6.56)	30.18	614 (8.20)	32.86	82 (7.35)	26.79
Total	2652 (27.75)	100.00	275 (21.74)	100.00	1868 (24.95)	100.00	306 (27.44)	

	File	Left Context	Hit	Right Context
1	558.txt	library so they can get the information about their subject.	Moreover,	technology can help a school district find their highly
2	778.txt	a good idea, because holding nine books daily is unhealthy.	Moreover,	technology can help the students to communicate with their
3	1918.txt	will make learning not being boring and keep them engaged.	Moreover,	technology can help students improve their practical skills which
4	278.txt	anytime you want from your mobile phone, laptop, or tablet.	Moreover,	technology is also a quicker device to find the
5	1488.txt	allows accesses to materials and support at anytime and anywhere.	Moreover,	technology is empowering students to learn more about different
6	568.txt	technology to connect with students irrespective of their geographical locations.	Moreover,	technology is helping instructors to lecture and provide learning
7	498.txt	internet and benefit from people that know more than us.	Moreover,	technology allowed students to finish everything online without having
8	518.txt	become easy, as Email and social media helped with that.	Moreover,	technology allowed students to register in online courses. Online
9	1278.txt	to expand their knowledge and increase their level of awareness.	Moreover,	technology also is a trainer for people who cannot
10	458.txt	the reason why students learn easily and quickly using technology.	Moreover,	technology could be the reason behind attracting the students

Fig. 1. *Example of Concordance Lines of 'Moreover'.*

unequally distributed, addition devices occupied the largest proportion (42.38%), indicating that the most frequent function of transitions in students' L1 was adding new points to an argument. Normalised frequencies of markers of addition were always less frequent than in their L1, though patterns across proficiency levels seemed inconsistent. When normalised for the lengths of texts, addition markers occurred more frequently in lower proficiency texts (10.58), at a rate slightly lower than in their L1 Arabic writing (11.76). While the distributions of addition markers across higher and lower proficiency writers were similar, as will be seen, the distribution of particular markers differed noticeably across the most and least proficient writers sampled in this study.

Compare and contrast devices occurred at nearly half the frequency of addition features in L1 Arabic (11.76 versus 6.83). These markers occupied fewer than a quarter of all Arabic transitions (24.62%), suggesting that students were less able or willing to juxtapose and adjudicate contrasting arguments in their written Arabic. Interestingly, lower proficiency writers used noticeably more compare and contrast markers (9.51) than higher proficiency ones (6.64) and in L1 Arabic. Such use indicates an overtly learned strategy or mechanical approach to signalling comparison and contrast that does not necessarily transfer from students' L1. The remaining category of markers served to elaborate the consequence(s) of propositional content and occupied approximately one-third of all transitions in L1 Arabic. As with addition markers, use among higher proficiency L2 students was substantially lower than in their L1, showing that successful use of such markers requires learners to be circumspect when applying metadiscursive conventions from their first language. Consequence devices exhibited the largest variation in the distribution of use across L2 English proficiency levels, with a 6.02% difference between the average (32.86%) and lower proficiency writing (26.79%). Students with average proficiency were the most prevalent users of consequence markers, indicating an overuse of such devices relative to more competent writers. Examples of students' use of transition markers in their texts are shown in Appendix C.

3.2. Patterns of use of individual transition markers

Table 4 outlines the raw and normalised frequencies of all Arabic and English TMs examined in the present study. Several noteworthy trends are visible among discrete addition markers. First, the devices 'also' and 'and' constituted a significant portion of the English addition markers, a tendency most acute among lower proficiency writers, for whom the two constituted 79.66% of all TMs. A similar finding is apparent across the Arabic TMs, with كذلك/أيضا and و constituting 82.96% of all addition devices, suggesting that the high prevalence of 'also' and 'and' in L2 English writing results from L1 Arabic transfer. While normalised frequency counts of 'and' among weaker writers and in L1 Arabic equivalent were not too dissimilar (4.13 versus 4.60), the disparity between 'also' and لكن was noticeable. The results show the prevalence of 'also' was 1.75 times less than the Arabic equivalents, indicating that lower proficiency students were aware of the need to lessen their dependence on 'also', although they were not as successful as stronger writers.

In conjunction with the overreliance on 'also' and 'and', a lack of flexibility in affixing propositional content together was further evinced in the absence of five addition markers from less proficient writers. As learners' proficiency levels increased, the prevalence of 'also' and 'and' fell, albeit usage rates of 'also' among average proficiency students (40.00%) differed only slightly from less competent users (40.68%). Interestingly, all examined devices occurred in the English writing of average proficiency students, likely reflecting the outcomes of explicit teaching of addition TMs (evident by the prevalence of 'in addition', 'furthermore', and 'moreover' – markers taught on learners' supplementary English programmes). There was a nearly half reduction in the prevalence of 'also' among higher proficiency learners (20.56%). In contrast, such learners indicated a preference for more academic linking adverbials ('additionally, 'moreover') and demonstrated more grammatically complex devices of addition in their writing (e.g., 'as well as', 'in addition to', 'not to mention'). Not all addition markers were represented in higher proficiency student texts, perhaps indicative of more implicit textual cohesion strategies.

The results for markers of comparison and contrast indicate some unexpected patterns. As with clauses of addition, L2 students' use of English comparison and contrast markers was far from evenly distributed across the possible devices. Instead, usage clustered around several highly prevalent markers, notably, 'but', 'however', 'on the other hand', and 'while'. Both lower and higher-proficiency writers demonstrated the narrowest range of compare and contrast TM use, the former owing to a lack of flexibility and the latter likely out of a preference for more sophisticated cohesion and coherence strategies. It is probable that L1 transfer also played a role. Among Arabic comparison and contrast markers, there was far greater reliance on one particular structure, لكن ('but'), representing 63.7% of all compare and contrast transitions and around ten times more frequent than any other device in this category. However, it is not immediately clear why the rate of 'but' in higher proficiency writing (2.69) was the closest to L1 Arabic (3.21).

Against expectations, higher proficiency writers indicated a greater reliance on the coordinating conjunction 'but' (45.95%). In contrast, average and weaker writers displayed about one-third lower usage rates.

Table 4
Frequencies and proportions of transition markers across L1 Arabic and L2 English (according to proficiency level).

Frequencies and proportions of transition markers across L1 Arabic and L2 English (according to proficiency level)

Arabic transition markers	L1 Arabic			English transition markers	L2 English Higher proficiency			Average proficiency			Lower proficiency		
	Raw (normed)		%		Raw (normed)		%	Raw (normed)		%	Raw (normed)		%
Addition													
• علاوة على ذلك	20	(1.13)	0.01	additionally,	3	(0.24)	2.80	8	(0.11)	1.17	1	(0.09)	0.84
• بالإضافة إلى	76												
• إضافة إلى	12												
• يضيف إلى	0	(0.00)	0.00	add to	1	(0.08)	0.93	2	(0.03)	0.29	0	(0)	0.00
• مرة أخرى/ تارة أخرى	6	(0.08)	0.57	again	0	(0)	0.00	1	(0.01)	0.15	0	(0)	0.00
• مجددا	1												
• مرة ثانية	0												
• مرارا و تكرارا	1												
• أيضا	362	(7.56)	51.57	also	22	(1.74)	20.56	274	(3.66)	40.00	48	(4.30)	40.67
• كذلك	82												
• كما (أن)	279												
• و(حرف الواو)	440	(4.60)	31.38	and	30	(2.37)	28.03	158	(2.11)	23.06	46	(4.13)	38.98
• فضلا عن	4	(0.04)	0.29	as well as	9	(0.71)	8.41	15	(0.20)	2.19	4	(0.36)	3.38
• وكذا	0												
(see 'additionally')				besides	1	(0.08)	0.93	12	(0.16)	1.75	1	(0.09)	0.84
• مزيد / المزيد/ مزيدا	49	(1.18)	8.06	further	0	(0)	0.00	1	(0.01)	0.15	0	(0)	0.00
• إضافية	2												
• آخر	62												
(see 'additionally')				furthermore	6	(0.47)	5.60	55	(0.73)	8.03	4	(0.36)	3.38
(see 'additionally')				in addition	7	(0.55)	6.54	58	(0.77)	8.47	5	(0.45)	4.23
(see 'additionally')				in addition to	5	(0.4)	4.67	17	(0.23)	2.48	3	(0.27)	2.54
(see 'additionally')				moreover	18	(1.42)	16.82	77	(1.03)	11.24	5	(0.45)	4.23
• ليس هذا فحسب	1	(0.04)	0.29	not only this	1	(0.08)	0.93	1	(0.01)	0.15	0	(0)	0.00
• ليس هذا فقط	3												
(see 'not only this')[a]				not only that	0	(0)	0.00	2	(0.03)	0.29	1	(0.09)	0.84
• ناهيك عن	6	(0.06)	0.43	not to mention	4	(0.32)	3.73	4	(0.05)	0.58	0	(0)	0.00
Total	1402				107			685			118		
Compare/contrast													
• بديل / بديلا / كبديل	27	(0.28)	5.60	alternatively	1	(0.08)	1.36	1	(0.01)	0.20	0	(0)	0.00
• بالرغم من / رغم/	21		6.43	although	2	(0.16)	2.73	29	(0.39)	5.68	3	(0.27)	3.23
• مع ذلك	10	(0.32)											
• في نفس الوقت	15	(0.16)	3.11	at the same time	3	(0.24)	4.10	9	(0.12)	1.76	1	(0.09)	1.07
• (و) لكن	307	(3.21)	63.70	but	34	(2.69)	46.57	176	(2.35)	34.50	29	(2.60)	31.19
• (و) على النقيض	5	(0.39)	7.68	conversely	0	(0)	0.00	1	(0.01)	0.20	0	(0)	0.00
• (و) بالمقابل / (و) في المقابل	15												
• وعلى العكس / و بالعكس من ذلك	3												
• (و) من جهة أخرى	14												
See 'conversely'				despite	0	(0)	0.00	15	(0.20)	2.94	1	(0.09)	1.07

See 'conversely'				in spite of	1	(0.08)	1.36	2	(0.03)	0.39	0	(0)	0.00
• وبالمثل/نحو مماثل/غرار	2	(0.02)	0.41	equally	0	(0)	0.00	1	(0.01)	0.20	0	(0)	0.00
See 'although'				even though	0	(0)	0.00	7	(0.09)	1.37	4	(0.36)	4.30
See 'although'				however	13	(1.03)	17.80	85	(1.14)	16.67	14	(1.26)	15.05
See 'conversely'				in contrast	0	(0)	0.00	2	(0.03)	0.39	0	(0)	0.00
See 'equally'				likewise,	0	(0)	0.00	1	(0.01)	0.20	0	(0)	0.00
				nevertheless	1	(0.08)	1.23	4	(0.05)	0.65	0	(0)	0.00
				nonetheless	0	(0)	0.00	0	(0)	0.00	0	(0)	0.00
• ليست دائما الحالة	0	(0.00)	0.00	not always the case	0	(0)	0.00	1	(0.01)	0.20	0	(0)	0.00
See 'conversely'				on the contrary	0	(0)	0.00	3	(0.04)	0.59	0	(0)	0.00
• و من جهة أولى	14	(0.15)	2.90	on the first hand	0	(0)	0.00	2	(0.03)	0.39	1	(0.09)	1.07
See 'on the first hand'				on the one hand	1	(0.08)	1.36	7	(0.09)	1.37	2	(0.18)	2.15
• من جهة أخرى	1	(0.01)	0.21	on the other hand	4	(0.32)	5.47	45	(0.60)	8.82	9	(0.81)	9.67
See 'on the one hand'				on the other side	1	(0.08)	1.36	7	(0.09)	1.37	3	(0.27)	3.23
• إنما	10	(0.10)	2.07	rather	0	(0)	0.00	1	(0.01)	0.20	0	(0)	0.00
See 'equally'				similarly,	0	(0)	0.00	1	(0.01)	0.20	1	(0.09)	1.07
See 'on the hand'				the other side	1	(0.08)	1.36	7	(0.09)	1.37	3	(0.27)	3.23
• للرد على هذا الادعاء	0	(0.00)	0.00	to counter this argument	0	(0)	0.00	1	(0.01)	0.20	0	(0)	0.00
See 'although'				though	1	(0.08)	1.36	7	(0.09)	1.37	5	(0.45)	5.38
• بينما	27	(0.28)	5.60	whereas	0	(0)	0.00	6	(0.08)	1.17	2	(0.18)	2.15
• إما.... أو.....	11	(0.12)	2.28	whether...or	3	(0.24)	4.10	32	(0.43)	6.27	7	(0.63)	7.53
See 'whereas'				while	6	(0.47)	8.21	50	(0.67)	9.80	8	(0.72)	8.60
See 'but'				yet	2	(0.16)	2.73	11	(0.15)	2.16	0	(0)	0.00
Total	482				73			510			93		
Consequence													
• تبعا ل / وفقا ل / (و) لذا / وعليه	30	(0.31)	4.80	accordingly	1	(0.08)	1.23	1	(0.01)	0.16	0	(0)	0.00
• (و) نتيجة لذلك / (و) نتج عن	7	(1.13)	17.28	as a consequence	0	(0)	0.00	3	(0.04)	0.49	0	(0)	0.00
• ومن ثم	23												
• و بالتالي	78												
See 'as a consequence'				as a result	7	(0.55)	8.43	15	(0.20)	2.44	2	(0.18)	2.44
• لسبب / بسبب / لأن	231	(2.42)	36.96	because	23	(1.82)	27.71	214	(2.86)	34.85	40	(3.59)	48.79
See 'because'				because of	7	(0.55)	8.43	49	(0.65)	7.98	6	(0.54)	7.32
See 'as a consequence'				consequently	1	(0.08)	1.23	11	(0.15)	1.79	0	(0)	0.00
See 'as a consequence'				hence	3	(0.24)	3.61	7	(0.09)	1.14	1	(0.09)	1.22
• ادى إلى / مما أدى إلى	51	(1.25)	19.04	lead to	5	(0.40)	6.02	36	(0.48)	5.86	13	(1.17)	15.85
• يؤدي إلى / مما يؤدي إلى	66												
• ترتب على / يترتب على	2												
See 'as a consequence'				result in	0	(0)	0.00	6	(0.08)	0.98	1	(0.09)	1.22
• بما أن	0	(0.00)	0.00	since	5	(0.40)	6.02	23	(0.31)	3.74	2	(0.18)	2.44
• (و) لذلك	82	(0.86)	13.12	so	10	(0.79)	12.05	124	(1.66)	20.20	12	(1.08)	14.63
• (و) من أجل	21	(0.22)	3.36	so as to	0	(0)	0.00	1	(0.01)	0.16	0	(0)	0.00
• لايزال / مازال / لازال / لازالت / تزال	10	(0.10)	1.60	still	3	(0.24)	3.61	17	(0.23)	2.77	0	(0)	0.00
• يرجع الفضل / يعود الفضل / بفضل	24	(0.25)	3.84	thanks to	0	(0)	0.00	15	(0.20)	2.44	0	(0)	0.00
• نتيجة أخرى	0	(0.00)	0.00	another result	0	(0)	0.00	1	(0.01)	0.16	0	(0)	0.00
See 'as a consequence'				thereby	1	(0.08)	1.23	3	(0.04)	0.49	0	(0)	0.00
See 'as a consequence'				therefore	11	(0.87)	13.25	55	(0.73)	8.96	4	(0.36)	4.88
See 'as a consequence'				thus	5	(0.40)	6.02	29	(0.39)	4.72	1	(0.09)	1.22
Total	625				83			614			82		

[a] There is no difference between 'not only this' and 'not only that' in Arabic.

[a] There is no difference between ‘not only this’ and ‘not only that’ in Arabic.

The linking adverbials' however' and 'on the other hand' featured prominently in the dataset, with the prevalence of 'however' being largely consistent across proficiency levels, while 'on the other hand' seemed to associate with less proficient writing (9.68%). 'While' indicated similar usage rates across proficiency levels. This may also be surprising since the flexible use of 'while' to affix two contrasting clauses is more syntactically complex than the linking adverbial 'however'. Nevertheless, the presence of 'while' in the dataset does not automatically indicate correct usage. The item was likely misused, particularly in sentence fragments.

Concerning consequence transitions, a distribution clustered around several prevalent forms was also evident, with a greater diversity of choices made by higher proficiency writers. Lower proficiency users heavily relied on 'because' (48.79%) and, to a lesser extent, 'so' (14.63%). Various forms of the lemma' lead to' were also apparent (15.85%). The commonness of these three items in L2 English appears reflective of approaches to coherence and cohesion in L1 Arabic, where synonyms of these markers prevailed both in terms of their distribution among all consequence markers and in terms of their normalised frequency. Eight of the 18 consequence forms investigated remained unused by weaker writers, further evincing students' lack of flexibility. In contrast, all 18 of the examined consequence markers were visible across average student writing, albeit for several items, only a handful of incidences were apparent (e.g., 'as a consequence', 'thanks to', 'another result is').

As with their weaker counterparts, average writers were drawn to 'because', although the proportion of use was noticeably less prevalent (2.86). Interestingly, 'so' featured considerably more prominently (1.66) when compared to higher and lower proficiency writing for reasons that are not entirely clear. Higher proficiency writers evinced notably less reliance on 'because' (1.82) and 'so' (0.79), with higher rates of academic linking adverbials that mark consequence. 'As a result', 'hence', and 'thus' were all indicative of higher (and to a lesser extent, average) proficiency writing compared to weaker L2 English texts. 'Therefore' appeared better known to weaker writers, although it still featured a normalised prevalence (0.36) that was less than half that of stronger writers (0.87).

3.3. Students' metalinguistic understanding of their use of transition markers

This section presents students' metalinguistic understanding of TMs, showing the reasons for using them, students' views about (in)frequent use, and their views of (lack of) variety in their use of TMs in argumentative writing.

3.3.1. Reasons for using transition markers

Students showed that they use transition markers (TMs) for some reasons. Firstly, students use TMs to attract readers' attention:

> *I used different conjunctions such as (therefore لكن, but لذلك… etc.) to attract the reader to think about the connections between the sentences and make my writing more appealing to the reader (26FA).*

Secondly, they use TMs to clarify meaning and avoid confusion:

> *Without transition markers, the meaning would not be clear, and we would feel something was missing. The sentences would be disconnected and fragmented (17FE).*

> *Thirdly, TMs are used for the organisation of writing:*

> *I used conjunctions to arrange ideas and paragraphs and make the paragraphs consistent and organised (17FE).*

Another reason for using TMs is to avoid repetition:

> *I used many linking words to avoid repetition (16FE).*

Finally, students use TMs for cohesion:

> *The most important function of conjunctions is to link sentences together as they help with the flow of reading and writing (1ME).*

3.3.2. (In)Frequency of using transition markers

One student expressed her infrequent use of TMs in Arabic due to her lack of knowledge, as shown below:

> *I always finish a sentence and start another; most of the time, I do not see the need to use linking here. Connecting the sentences was sometimes hard because I did not know many connectors in Arabic. (12FA)*

On the other hand, other students expressed their frequent use of TMs for different purposes. For example, one view used TMs frequently for clarity of writing:

> *I used many conjunctions such as (despite, however); they would clarify the different points of view. (12FE).*

Another view used TMs regularly for cohesion and sequence, as shown below:

> *I used many linking words such as (furthermore, to start with, secondly, to conclude, moreover, however, on the other hand) because I learned that they are important to link the sentence to the next sentence. It may be opposing, or it may be adding more information. (33ME)*

> *I used many conjunctions of different types to arrange the paragraphs to distinguish between different types of paragraphs (17FA)*

3.3.3. (Lack of) variety of transition markers

Students showed their limited variety of TMs due to writing time and lack of knowledge about the different purposes of TMs.

> *I didn't use many conjunctions; I used most (and, but), but I did not use (however, despite, in addition, moreover, more). This is because I was supposed to vary in the use of conjunctions and to attract the reader more, but unfortunately, the time was tight. (36E ME)*

> *I used a few conjunctions in my Arabic essay as I do not know many conjunctions and their functions. (40MA)*

3.3.4. Variety of transition markers

Six students pinpointed that they used transitions for the following varied purposes:

> *They help the reader to move from one idea to another (30FE).*

They show the reader the different functions of markers for contrast and addition (26FE).

> *I used varied conjunctions for different purposes in my writing; to express the result as an example (as a consequence), to summarise in the conclusion as an example (all in all) and to add more supporting ideas (furthermore, in addition, besides that) to show the causal relationship (because, due to). (14B FE)*

> *I use conjunctions to make it easier for the reader to move smoothly from one point to another. (36A MA)*

4. Discussion

The study found that the learners went to greater lengths to establish coherence and cohesion through explicit TMs in their L1 Arabic texts than in L2 English (Alghazo et al., 2021; Sultan, 2011). This points to fundamental differences in how writers in Arabic and English guide the reader in processing and understanding their intended message in academic discourse. Some authors have argued that the higher prevalence of TMs in Arabic is evidence that Arab-speaking writers give greater thought to matters of textual organisation (Alghazo et al., 2021). The interviews revealed that our participants generally demonstrated

consideration for the semantic and syntactic implications of TMs, albeit several expressed a linear association between TM frequency and language proficiency. Indeed, a few individuals referenced a lack of knowledge of metadiscourse markers in Arabic as an obstacle to selecting appropriate markers in L2 English. The students did not appear to be aware that the overuse of TMs could also negatively impact the reader, a finding with important pedagogical implications. It has also been suggested that the oral tradition manifests itself in Arabic prose (Hinkel, 2005), evident in the dataset through the high usage rates of TMs commonly found in speech. While our participants demonstrated awareness of the different semantic functions of TMs, they rarely made connections between particular markers and spoken or written registers.

Studies point to the implicit transition strategies in English as a marker of skilful coherence and cohesion (Mayor et al., 2007). While the frequent overt marking of clauses of addition, contrast, and consequence usefully involve the reader in the navigation of Arabic texts (Sultan, 2011), in English, marker overuse often indicates mechanical prose (Zamel, 1983) and phrasal redundancy (Basturkmen and von Randow, 2014). This was manifestly apparent in lower proficiency writers' normalised frequencies and distributions of discrete TMs, which often mirrored L1 Arabic. The interviews revealed that many in our sample believed that more implicit strategies for managing transitions might result in a lack of clarity, textual repetition, and even confusion for the reader. As such, while the interviews indicated that the learners had considered the impact of the utilised metadiscourse on the reader, their assumptions towards reader expectations, particularly in L2 English, were not always appropriate.

As reported elsewhere (Basturkmen and von Randow, 2014; Tan and Eng, 2014), as learners gained in L2 written language proficiency, the proportion of TMs as a total of all text tokens decreased. One explanation for this trend is that weaker writers can be 'over-zealous' in their use of metadiscourse, overusing various devices to compensate for linguistic deficiencies (Lorenz, 1998). We must stress that this is not a uniform finding across metadiscourse research. Other studies have reported increasing (Carrio-Pastor, 2013; Kuzborska and Soden, 2018) and flatlining (Bax et al., 2019; Yan et al., 2019) rates of transition marker use as L2 language proficiency improves. It is likely that the idiosyncrasies of the sample and task, particularly Arabic as learners' L1, the rhetorical requirements of the essay task and the timed conditions in which the essays were written, explain in part the decreasing prevalence of TM use. We also strongly suspect that our sample of higher proficiency writers employed other non-explicit strategies to achieve textual coherence (Bax et al., 2019), attesting to the complexities of managing textual relations in English academic writing.Where the results of our study cohere with research more broadly is the increasing variety of TMs on display as students' L2 proficiency level increases (Bax et al., 2019; Carrio-Pastor, 2013). This was particularly evident at the level of average language proficiency, which we attribute to the explicit teaching focus on TMs that occurred at this level (Burneikaitė, 2008). Higher proficiency learners exhibited lower TM variety across all devices (with several in the compare/contrast and consequence categories not being utilised), perhaps indicating that these successful learners had developed tried-and-tested coherence and cohesion strategies that they were keen to follow. Lower proficiency users were found to use a narrower range of devices and rely on markers common to spoken English (Noble, 2010). Nevertheless, it was also the case that certain transitions ('and', 'also', 'because', 'but', and 'so') were preferred by both higher and lower-proficiency writers, a phenomenon found elsewhere (Tan and Eng, 2014) that may be attributed to higher-level students' attention being focused on propositional content or characteristics of a risk-averse approach to essay organisation.

5. Conclusion

This study has analysed three sub-categories of TMs used by L1 Arabic and L2 English university students of different proficiency levels and found great variation. Overall, 62 discrete transitions of addition, compare and contrast, and consequence were identified across the L2 English sub-corpora, while 32 translated equivalents were evident in the L2 Arabic texts. Students used higher quantities of TMs in their L1 Arabic writing than in L2 English (2449 and 24.71, respectively). Consequence markers exhibited the largest variation in the distribution of use across L2 English proficiency levels. They occupied approximately one-third of all TMs in L1 Arabic. However, compare and contrast markers constituted fewer than a quarter of all Arabic transitions (24.62%). Interestingly, lower proficiency writers used noticeably more compare and contrast markers (9.51) than higher proficiency ones (6.64) in L1 Arabic.

In response to the second research question, the findings revealed that the participants highlighted three main issues related to the use and variety of TMs. First, the participants foregrounded their varied use of TMs to attract the readers' attention, make meaning clear, organise writing, avoid repetition, help the reader transition between ideas, expressing the different functions of markers (i.e., addition, contrast, compare, consequence, summarise, and show causal relationships). On the other hand, the participants voiced their infrequent use and unvarying TMs due to a lack of knowledge about TMs and writing under controlled conditions.

The current study offers some important pedagogical implications. Firstly, L1 Arabic programs and instructors at the university level need to include general metadiscourse markers and transitions in their curriculum and instruction and assessment to help university students develop their argumentative writing successfully when writing for different communicative purposes and in different contexts. Secondly, writing instructors need to highlight the importance of audience to raise students' awareness of their readers' needs and the communicative purpose of writing. Furthermore, it is recommended that writing instructors spotlight the uses and functions of different TM categories (addition, compare/contrast, and consequence) appropriate to different genres and communicative functions. Finally, It is important that writing instructors diversify their teaching strategies using cooperative learning, discussion, comprehension checking, exemplification and graphic organisers (Ahmed, 2019) to raise students' awareness about the negative impact of overusing TMs on the reader through teaching, feedback provision (Ahmed et al., 2020) and assessment of writing (Ahmed and Abouabdelkader, 2018).

It is important to highlight some limitations of the current study. First, argumentative writing was the genre of writing used in the current study. Other writing genres could be used for further research and may yield variations in transition marker use across L1 Arabic and L2 English. Second, the sample of the study was limited to 195 students. Larger samples could lessen the influence of the idiosyncrasies of the particular cohort of students recruited. Our sample was not balanced in gender (three females to every one male). Researchers may conduct research with a more balanced sample. Thirdly, our study is limited to university students at the undergraduate level.

Further research could be conducted with postgraduate or pre-university students to assess the differences. We are grateful to our students for furthering our understanding of metadiscourse marker use through the metalinguistic understandings they shared with us. Future research could explore students' metalinguistic understanding of other interactive or interactional metadiscourse resources. Metalinguistic understanding would be valuable for readers' awareness and authorial stance (Myhill et al., 2023).

Declaration of competing interest

There are no conflicts of interest with any other parties.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.amper.2023.100110.

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