



Microgenetic analysis of written languaging attributes on form-focused and content-focused e-collaborative writing tasks in Google Docs

Pooneh Kazemi¹ · Natasha Pourdana¹ · Gholamhassan Famil Khalili¹ · Payam Nour²

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Abstract

Written languaging (WL) as a facilitator of second/foreign language (L2) learning has been investigated by several researchers. Yet, the dynamic nature of WL episodes has remained under-researched. This study aimed to examine whether the focus of e-collaborative writing and the mediation modalities in Google Docs would have differential impacts on the attributes of WL episodes. To do so, 68 Iranian English-as-a-Foreign-Language (EFL) university students were selected, paired, and randomly assigned to two advanced-level groups. By producing WL episodes, pair languagers collaborated on either a form-focused (translation) or a content-focused (data commentary) procedural writing task. Both groups received asynchronous teacher-led mediation and Google Docs automated mediation on their task performance. The WL episodes were analyzed for their quantity, focus (on grammar, lexis, and discourse markers), and resolution. Statistical results indicated that (1) the form-focused writing task could generate more WL episodes than the content-focused writing task, (2) pair languagers focused on grammar more than lexis and discourse markers on both tasks, (3) the teacher-led mediation and Google Docs automated mediation could generate a similar number of WL episodes, and (4) Google Docs automated mediation caused more successful resolution of WL episodes than teacher-led mediation. Pedagogical implications of the study recommend that L2 teachers blend task-based writing, student collaboration, and mediation modalities in e-learning contexts. The re-evaluation of Google Docs for the restricted focus of its automated mediation on lower-level linguistic features of grammar and lexis can also direct future advanced educational technology research.

Keywords Automated · E-collaboration · Google Docs · Mediation · Task focus · Written languaging

✉ Natasha Pourdana
Natasha.pourdana@kia.ac.ir; Natasha.Qale@gmail.com

Extended author information available on the last page of the article

1 Introduction

Recently, second language acquisition (SLA) researchers have lately shown a growing interest in the constructive role of *linguaging* in L2 learning improvement (Falhasiri, 2021; Ishikawa, 2018; Suzuki & Storch, 2020; Tang, 2019; Zhang, 2021). Originated from Vygotsky's sociocultural theory of mind (SCT, 1987), linguaging is defined as “an action - a dynamic, never-ending process of using language to make meaning”, and “to shape knowledge and experience through language” (Swain, 2006, pp. 96-98). Swain (2006) argued that the second/foreign language (L2) learners can turn linguaging into a “tool of the mind, mediating the cognition and recognition of experience and knowledge” (p. 106) and a platform for learning complexities in the target language form.

Recently, SLA research has produced strong evidence that, through linguaging, L2 learners seem more capable of regulating their thoughts, and achieving better performance on challenging tasks (Lavasani et al., 2021; Moradian et al., 2017; Storch, 2013; Suzuki & Storch, 2020). Even though the significant role of linguaging as a facilitator of L2 learning has been capitalized, the factors that can determine the facets of linguaging episodes on various writing tasks are under-researched. Furthermore, the empirical studies on linguaging situated before/after the mediation on writing tasks are still in their infancy with a few research reports (Falhasiri, 2021; Moradian & Nasab, 2019; Yamashita, 2021). Therefore, to fill the large gap in the linguaging research, the researchers in this study examined the potential interplay between written linguaging and the mediation modalities in shaping the dimensions of WL episodes when the L2 learners collaborate on form-focused and content-focused writing tasks in Google Docs.

2 Literature review

2.1 Written linguaging

Linguaging is not always vocal. Suzuki (2012) pioneered the notion of *written linguaging* (hereafter, WL) as the “equivalent of private speech, but in writing” (p. 4). Later, Suzuki (2017) promoted major benefits of WL to L2 learners, such as (1) providing more time and space to focus on the language form, (2) releasing extra cognitive load and allowing more in-depth language processing, and (3) offering an external memory space. Suzuki even argued that WL “might stimulate more elucidation and clarification of thoughts than oral linguaging” (2017, p. 462). In other words, by producing WL episodes, the L2 learners' ideas are more effectively shaped into written artifacts.

SLA researchers have lately shown a growing interest in the constructive role of WL in L2 learning improvement (Falhasiri, 2021; Ishikawa, 2018; Suzuki & Storch, 2020; Tang, 2019; Zhang, 2021). Ishikawa (2018) examined the potential of linguaging to facilitate learning grammatical points by 83 Japanese EFL

learners. They were assigned to four groups at higher/lower levels of language proficiency who completed either a production-oriented or a recognition-oriented grammar task with and without languaging. Ishikawa reported that the EFL learners in the languaging groups (both at higher and lower levels) had significant improvement in their performance on the production-oriented grammar task. Moreover, by producing languaging episodes, the lower-level group improved their English grammar more than the higher-level group. In a qualitative study, Falhasiri (2021) also examined 18 EFL learners who were required to simultaneously produce WL and jot down self-reports on their writing errors after receiving teacher corrective feedback (CF) in Google Docs. The researcher reported that producing languaging episodes served the participants with a medium of self-scaffolding, and offered the researcher a tool to study the students' engagement in processing the received CF.

Swain and colleagues further examined how collaborative languaging might further enhance language learning development (Swain, 2010; Swain & Watanabe, 2013). They argued that L2 learners can “scaffold one another through languaging when they participate in collaborative activities, and such collaboration results in the co-construction of linguistic knowledge” (Swain & Lapkin, 2008, p. 564). Accordingly, L2 learning is effectively mediated by producing egocentric dialogues with the self (i.e., self-languaging) or collaborative dialogues with others (i.e., pair/peer languaging) (Cao & Lin, 2020; Simard & Zuniga, 2020). In addition, while L2 learners collaborate in completing challenging tasks, an opportunity rises to produce a larger body of languaging episodes (Cho, 2018). SLA research on the collaborative writing tasks suggested that once engaged in peer/pair languaging, the L2 writers focus on a wide range of grammatical forms, lexical choices, or even mechanics of writing (Abe, 2020; Lin, 2020; López-Pellisa et al., 2021). In other words, collaboration can amplify the impact of languaging on L2 learning development. As a result, the concurrence of languaging and collaboration can turn into a social tool that facilitates resolving linguistic problems (Ishikawa, 2018), internalizing the co-built knowledge and having better access to rich resources of knowledge (Moradian et al., 2017), improving writing skills, and language learning in general (Azkarai & Kopinska, 2020).

On the same track, Storch (2013) has made a functional classification of languaging episodes in terms of their focus on the grammatical forms (grammar-based), lexical choices (lexis-based), mechanics of writing (mechanical), and discourse markers (discourse-based). In addition, Storch speculated that the attributes of languaging episodes might be task-dependent. In other words, on the form-focused tasks (e.g., translation, error identification, or dictogloss), the L2 learners seem to produce more grammar-based languaging episodes (Behbahani et al., 2011; Pourdana & Behbahani, 2012). In contrast, on the content-focused tasks (e.g., picture description or composition), L2 learners most likely produce more lexis-based languaging episodes while their focus on the language form is incidental or unengaged (Pica et al., 2006; Spada & Tomita, 2010). However, Storch's line of argument was inconclusive and she called for further research on the topic.

2.2 Linguaging in e-collaboration

In modern educational systems, computer-mediated communication (CMC) technologies have become widely popular to create a learner-centered and collaborative environment and to eliminate the techno-stress, embarrassment, and anxiety that students usually feel in real classroom contexts (Ene & Upton, 2018). Through synchronicity of interactions, the CMC platforms can offer the L2 learners a chance to generate and share new ideas and receive feedback from more knowledgeable others (i.e., peers or teachers) (Engerer, 2020, Rafi et al., 2022). Moreover, CMC can incorporate a variety of text-, audio-, or video-based modalities synchronously in real-time or asynchronously with a time lag in distance learning.

Recently, distance education has turned into a global reality even in under-developing countries. In less industrialized nations, e-learning faces serious problems due to the outdated infrastructure, huge digital divide, teachers' low expertise, and learners' inadequate computer literacy (Hsieh, 2017). The situation has become even worse with the COVID-19 pandemic crisis which pushed many teachers and students towards distance education. In this challenging time, user-friendly CMC platforms such as Google Docs have reached the peak of popularity. A computer-mediated Web 2.0 word-processing application, Google Docs is a cost-free virtual interface that allows L2 learners to easily create, peer-edit, share, and publish multi-drafted documents (Ebadi & Rahimi, 2017). Among the substantial features of Google Docs are its four major options of Google Document, Google Spreadsheet, Google Presentation, and Google Drawing, which serve the L2 writers with simplicity, manageability, and high ecological validity in writing tasks (Yamashita, 2021). Another distinctive pedagogical feature of Google Docs is its potential to serve the L2 learners with automated mediation which is triggered by their errors of language form (Yang, 2010). Such synchronous mediation corroborates the routines of teacher, self, and peer assessment. In other words, Google Docs is closely aligned with Vygotsky's SCT model of learning as it generates endless possibilities for collective scaffolding, active participation, and written languaging (Lee & Abdul Rabu, 2021).

Of rising interest in SLA research is the potential of Google Docs to provoke a large amount of interaction through text-based messaging on collaborative writing tasks (Magnifico et al., 2020; Yamashita, 2021). In other words, e-collaboration in Google Docs is believed to provide the L2 learners with more chances to notice their language errors, to give/receive feedback, and to self-repair in a less stressful environment (Kim & Taguchi, 2016; Liu & Song, 2020; Storch, 2013). Among a few studies conducted on the dynamics of WL in e-collaboration, Shekary and Tahririan (2006), and Zeng and Takatsuka (2009) are prominent. Shekary and Tahririan (2006) required 16 Iranian EFL learners to complete several collaborative writing tasks in online chat rooms. The researchers attributed a large occurrence of WL episodes and their successful resolutions to the hybrid nature of e-collaboration which enhanced the process of noticing and active interaction in participants. Similarly, Zeng and Takatsuka (2009) analyzed the text-based WL episodes that 16 Chinese EFL learners produced while they were completing collaborative writing tasks on Moodle course management system. The researchers reported that text-based

linguaging could draw the L2 learners' attention to language forms, foster their peer interaction, and improve their language learning. The L2 learners' responses to a post-task survey supported the researchers' findings and revealed participants' enjoyment of e-collaboration.

2.3 This study

In this study, we have adopted a microgenetic approach to investigate the changes in *quantity* and *focus* of WL episodes which would occur through the EFL learners' collaboration on form-focused and content-focused writing tasks, and the *resolution* of WL episodes over the EFL learners' exposure to teacher-led mediation and Google Docs automated mediation. By definition, the microgenetic analysis examines the changes as they occur, thus attempts to identify and explain their underlying mechanisms. It involves repeated measurements from the same participants throughout their gradual progress in the domain of interest (Siegler, 2006). To fulfill the objectives of the study, we raised the following research questions:

- (1) Does EFL learners' e-collaboration on form-focused and content-focused writing tasks differentially affect the attributes of WL, in terms of their quantity and focus?
- (2) Do the teacher-led and Google Docs automated mediations differentially affect the resolution of WL episodes on form-focused and content-focused e-collaborative writing tasks?

3 Method

3.1 Context and participants

This research was conducted in 2020 in the middle of the COVID-19 outbreak in Iran. Sixty-eight Persian-speaking (their L1) EFL learners voluntarily joined this experiment. They were undergraduate students majoring in English Translation Studies whose ages ranged from 22 to 26 ($M = 24.08$, $SD = 1.71$) and their formal exposure to English was 13.2 years on average (Table 1).

As findings by Ishikawa and Suzuki (2016) suggested that the proficiency level of L2 learners can play a significant role in determining the quantity of languaging episodes, we decided to select a homogeneous sample of EFL learners at the advanced level. Therefore, the participants were selected through the purposive sampling method (Best & Kahn, 2006) out of a pool of 80 volunteers. To do so, we administered an online version of the Oxford Placement Test (OPT, Version 1.1, 2001) after its 60 items were converted into Google Forms, a free web-based survey administration software. The volunteers whose OPT scores indicated their language proficiency at the advanced level (48–54, C1 in OPT ranking system) were selected ($N = 68$, $M = 51.78$, $SD = .73$, Cronbach's $\alpha = .872$, representing strong test reliability).

Table 1 Participants' demographic information (%)

Participant	Gender	f	Age range	Major	Studying English	f	OPT score range	f
N = 68	Male, (17.64)	12	22-26	English Translation Studies	9 - 10 years, (26.47)	18	48 - 50, (41.17)	28
	Female, (82.36)	56			11 - 15 years, (73.52)	50	51 - 54, (58.82)	40

The participants were also homogeneous in terms of the university course units they had passed by the time of this study. Other prerequisites for participation included owning a smartphone, accessing the Internet, and signing in to Google Docs accounts. The participants self-selected their partners and were randomly assigned to a collaborative translation group (hereafter, CTG) ($N = 17$ pairs) and a collaborative data commentary group (hereafter, CDG) ($N = 17$ pairs). After group assignment, we compared the OPT scores of the two groups and found no significant between-group differences ($t(67) = .395, p = .79 > .05$).

The researchers in this study were three university instructors whose Ph.D. was in Teaching English as a Foreign Language (TEFL). They had around 15 years of experience in teaching academic writing and translation courses. A professional translator with a Master's degree in English Translation Studies collaborated with the researchers in preparing a translation model and rating the translation tasks.

3.2 E-collaborative writing tasks

The SLA researchers have agreed upon a broad definition of form-focused and content-focused tasks. Accordingly, the “form-focused task will mean any pedagogical effort which is used to draw the learners’ attention to language form either implicitly or explicitly” (Spada, 1997, p. 73), and the “content-focused tasks incorporate a primary focus on the meaning” as an opportunity to improve the L2 learners’ communicative skills (Van de Guchte et al., 2019, p. 311). The L2 pedagogical tasks usually range in this form-content continuum.

Conventionally known as a form-focused writing task, a translation task requires L2 learners to convey a message from the source language to the target language while their focus is more on the linguistic aspects of their output rather than the content of the message (Ishikawa, 2018). Alternatively, a data commentary is a content-focused writing task that requires the L2 learners to interpret the information demonstrated in a graphic prompt or a table and convert it into the written script (Wigglesworth & Storch, 2009). Both translation and data commentary tasks, when completed through collaboration and languaging, are deemed to improve language learning (Ishikawa, 2018; Storch, 2013).

In this study, our logic behind developing translation and data commentary tasks was functional as they stand at two ends of the form-content continuum (Storch, 2013). Both tasks were production-oriented, procedural at three stages, and paralleled by the topic of COVID-19 which balanced their cognitive loads. The Persian-to-English translation task was a documented bar graph adopted from AL-Khikani (2020) (Appendix A). It reported the susceptibility of ABO blood types to the COVID-19 infection in four sentences (counted words = 90, $M = 23$ per sentence). The CTG pair languages were asked to collaboratively translate the caption of the bar graph into English, while they were languaging in Google Docs. In parallel, the data commentary task required the participants to interpret the graphic data in the same bar graph (Appendix B). The CDG pair languages collaboratively

wrote a 100-word commentary report on the bar graph, while they were languaging in Google Docs. Both tasks were pilot-studied with 23 undergraduate students similar to the participants of the study whose task outcomes were co-rated by the researchers (96% of inter-rater agreement).

3.3 Procedure

This study commenced with two extra-curricular webinars on *Collaborative Written Languaging* and *Written Languaging in Google Docs* in March 2020. We believed that producing WL episodes in Google Docs was not a familiar practice to the participants. Therefore, tutoring the process of WL in Google Docs seemed necessary. After signing a formal consent form, the volunteers signed in to six virtual sessions of 90 minutes on the Zoom video conferencing. In the first webinar, we introduced the 80 attending volunteers (40 self-selected pairs) to the notion of WL by setting several procedural examples of languaging on challenging linguistic features while completing collaborative writing tasks. In the second webinar, the participants used their Google email (Gmail) accounts to sign in to Google Docs. In the Zoom meeting sessions, we shared the screen with the audience into a generated document file in Google Docs and live-streamed our pair languaging on a translation task and a data commentary task, separately. Also, a detailed tutorial was provided to the audience on how to decode the color-coded teacher-led mediation on their errors or how to decipher the automated mediation by Google Docs. In both webinars, our demonstrations were followed by the participants who volunteered to screen-share their pair languaging and collaborative task performance. Relied upon our observation checklists, we tactfully eliminated 10 volunteers who were not willing to either mutually collaborate or share their ideas through WL episodes.

After administering OPT and excluding two further volunteers whose OPT scores were below the threshold (C1 in OPT), we randomly assigned the 68 remaining participants to CTG and CDG pair languagers. They signed in their Google Docs accounts to collaborate on translation and data commentary tasks for 20 minutes (Stage 1). Within the next 24 hours, we provided the teacher-led mediation on the outcome of their task with a color-coded highlighting system. We also posted a model task (i.e., the researcher-made translation and data commentary model tasks) to the participants' Google Docs accounts. On Day 2, the CTG and CDG pair languagers noticed their highlighted errors and compared their task outcomes with the model task while they were producing WL episodes over the teacher-led and Google Docs automated mediations for 20 minutes (Stage 2). At this stage, no modification or correction was allowed. On Day 3, the CTG and CDG pair languagers revised their task outcomes while they were producing WL episodes for 20 minutes (Stage 3). We set the time limits for every stage of the task completion based on the average time the volunteers spent on their

demonstrations in the webinars. Yet, the participants self-reported 10 to 16 minutes to pass each stage (see Appendix C for samples of WL episodes by CTG and CDG pair languages) (Fig. 1). The CTG and CDG pair languages received synchronous Google Docs automated mediation in three stages of task completion.

3.4 Data analysis

Following the SLA literature on languaging, the attributes of WL were operationally defined in terms of the quantity of WL episodes, the type of focus in hered in WL episodes, and the resolution of WL episodes (Falhasiri, 2021; Swain, 2006; Swain & Watanabe, 2013; Yang, 2016). To extract and quantify the WL episodes, we adopted Swain’s definition of languaging episodes as “any part of a dialogue where students talk about the language they are producing, question their language use, or other- or self-correct their language production” (2001, p. 287). Furthermore, we encoded the focus of WL episodes into three types, following Yang’s (2016) typology:

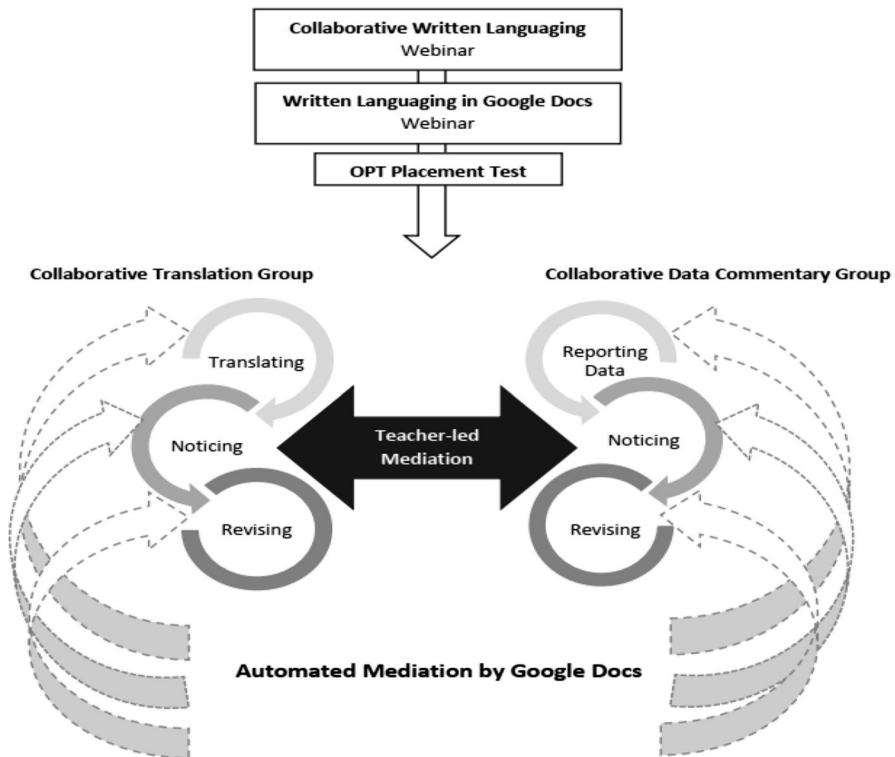


Fig. 1 The flow of the procedure

- (1) Grammar-based (G-WL) episodes focus on different aspects of morphology or syntax, including the use of articles, tenses, or voices. The following are examples of G-WL episodes:

A: *Blood type O group face fewer risks or faces? I'm not sure.*

B: *Group is plural. The face is correct.*

- (2) Lexis-based (L-WL) episodes focus on word choice, word meaning, or equivalence. The following are examples of L-WL episodes:

A: *People with Blood type O, or Blood O type?*

B: *Blood O type sounds better. But I am not sure!*

- (3) Discourse-based (D-WL) episodes focus on discourse markers, such as collocations, references, or conjunctions. The following are examples of D-WL episodes:

A: *We used but for ἄλλα (= *amma*). However is correct, too! What do you think?*

B: *Ah, I think we should change it to however.*

(The words were underlined for emphasis.)

Those WL episodes which could not be labeled for their focus, or the WL episodes on word spelling or punctuation were eliminated from data analysis (e.g., *Really?* or *Thank you!*). We carried out the coding and quantifying procedures collaboratively and we reached a full consensus.

Also, we adopted an extensive approach to the notions of teacher-led and automated mediation modalities in this study. The teacher-led mediation was defined as the asynchronous metalinguistic CF that we provided only at the noticing stage (Stage 2) of tasks completion. The teacher-led mediation focused on similar linguistic features that were used for encoding WL episodes (i.e., grammar, lexis, and discourse marker) (Yang, 2016). So that, the pair languages' ungrammatical structures were highlighted in yellow, lexical errors in blue, and inaccurate discourse markers in red in Google Docs. The procedures of highlighting, counting, and encoding were carried out collaboratively.

The automated mediation was provided synchronously by Google Docs at three stages of task completion. Through the waved underlining technique, Google Docs provided automated mediation on a wide range of grammatical and lexical errors, misspellings, abbreviations, and non-English words (e.g., *Goole* (for Google), *gr8*, or *COVID*). Automated mediation addressed the pair languages' committed errors on both WL episodes and task outcomes (i.e., *unfocused* feedback).

4 Results

The objectives of the study were to examine whether (1) the pair languages' e-collaboration on the form-focused (translation) and content-focused (data commentary) writing tasks would have differential impacts on the quantity and focus of WL episodes and whether (2) the teacher-led mediation and Google Docs automated mediation would

have differential impacts on the resolution of WL episodes produced on collaborative writing tasks.

4.1 Investigating the attributes of WL episodes

To investigate the first research question, the pool of WL episodes accumulated at three stages of tasks completion was analyzed for the quantity and type of focus (i.e., G-WL, L-WL, and D-WL). We set the alpha level at .05 for all statistical tests.

4.1.1 Quantity of WL episodes

A descriptive statistical analysis was carried out with frequency of the WL episodes. Table 2 indicates that the overall number of WL episodes produced on the translation task was more than those on the data commentary task (646 to 570, respectively). Accordingly, the average number of WL episodes produced by every pair of languagers on translation and data commentary tasks were 19.28 and 16.76, respectively. Finally, on translation and data commentary tasks, the majority of WL episodes were produced at the noticing stage (Stage 2) (407, 63%, and 288, 50.52%, respectively).

To further examine the significance of the observed differences in the distribution of WL episodes on translation and data commentary tasks, a table of contingency was produced by cross-tabulation of the WL episodes over the three stages of task completion. The result was significant and supported that the translation task generated much more WL episodes than the data commentary task (Pearson $\chi^2(2, 1216) = 23.79, p < .00$, Cramer's $V = .79$, interpreting a large effect size) (cf. calculating effect size in Lenhard & Lenhard, 2016).

4.1.2 Focus of WL episodes

Another descriptive statistical analysis was conducted with the distribution of L-WL, G-WL, and D-WL episodes. Table 3 indicates a similar proportional distribution of L-WL, G-WL, and D-WL episodes on both translation and data commentary tasks. Accordingly, on both tasks, G-WL episodes were the most frequent (300, 46.43%, and 271, 47.54%, respectively), followed by L-WL episodes

Table 2 Distribution of WL episodes

Stage	Translation task			Data commentary task		
	N (%)	M	SD	N (%)	M	SD
1	201 (31.11)	6.20	1.19	216 (37.89)	6.35	1.01
2	407 (63.00)	11.97	2.20	288 (50.53)	8.47	2.96
3	38 (5.89)	1.11	1.90	66 (11.58)	1.94	2.07
Total (%)	646 (100%)	19.28	4.19	570 (100%)	16.76	5.22

Table 3 Distribution of G-WL, L-WL, and D-WL episodes

Focus	Translation task			Data commentary task		
	N (%)	M	SD	N (%)	M	SD
L-WL	282 (43.65)	8.29	.91	250 (43.85)	7.35	.86
G-WL	300 (46.43)	8.82	2.01	271 (47.54)	7.97	1.01
D-WL	64 (9.92)	1.88	1.90	49 (8.61)	1.41	1.07

(282, 43.65%, and 250, 43.85%, respectively) and D-WL episodes as the least frequent (64, 9.92%, and 49, 8.61%, respectively).

We examined the significance of the observed similarity in the proportional distribution of WL episodes on translation and data commentary tasks by running another table of contingency. The result was insignificant which suggested that both tasks equally generated more G-WL than L-WL and D-WL episodes (Pearson χ^2 (2, 1216) = .74, p = .09, Cramer's V = .16, interpreting a weak effect size). To further examine the similar distribution of G-WL and L-WL episodes on the translation and data commentary tasks (582, 90.08% and 521, 91.39%, respectively), a pairwise post hoc comparison test was conducted. The result was still insignificant at Pearson χ^2 (1, 1101) = .05, p = .12.

4.2 Investigating the resolution of WL episodes

The resolution of WL episodes was measured in terms of the frequency of the errors which were successfully resolved by producing WL episodes at the revising stage (Stage 3). To examine the second research question, we partitioned the WL episodes into + resolved and – resolved. They were further divided by being produced either over the teacher-led mediation or Google Docs automated mediation on translation and data commentary tasks.

The statistical results in Table 4 indicate that pair languages could successfully resolve the majority of WL episodes as a response to teacher-led mediation on both the translation (91, 79.82%) and data commentary tasks (79, 82.29%). On the other hand, they could resolve 98.03% of the WL episodes (N = 150) on the translation task and 97.48% of WL episodes (N = 155) on the data commentary task as a result of Google Docs automated mediation.

Table 4 Distribution of \pm resolved WL episodes

Mediation type	Resolution	Translation task			Data commentary task		
		N (%)	M	SD	N (%)	M	SD
Teacher-led	+	91 (79.82)	2.67	3.12	79 (82.29)	2.32	3.47
	-	23 (20.17)	.00	.62	17 (17.70)	.50	1.02
Automated	+	150 (98.03)	4.41	4.11	155 (97.48)	4.55	3.31
	-	3 (1.96)	.08	.30	4 (2.51)	.11	1.05

To further explore the observed differences in the quantity of the + resolved WL episodes caused by teacher-led mediation and Google Docs automated mediation, we conducted a contingency table for the mediation modality (teacher-led vs. automated), the type of resolution (\pm resolved), and the task type (translation vs. data commentary). The result was significant which proved the superiority of Google Docs automated mediation over teacher-led mediation in resolving WL episodes (Pearson χ^2 (2, 522) = 44.32, $p = .00$, Cramer's V = .63, interpreting a moderate effect size). Another set of pairwise post hoc comparison tests was carried out between the mediation modality and the type of resolution (Table 5). The cross-examination was only significant for teacher-led and automated mediation modalities, with a moderate effect size (Cramer's V = .58).

A follow-up content analysis was carried out with the corpus of WL episodes in this study. The theme frequency analysis (Emerson et al., 2011) indicated that the average number of WL episodes which were produced by every pair languages over teacher-led mediation and Google Docs automated mediation were 3.20 to 5.01, respectively. We interpreted this larger average of WL episodes as the sign of more *attention* or *interest* that pair languages showed to Google Docs automated mediation. Moreover, by an in-depth analysis of the - resolved WL episodes (N = 47), we detected three themes in the pair languages' responses to received mediations, including *failure to decode* the mediation (18, 38.29%), *ignoring* the mediation (15, 31.92%), and *rejecting* by being critical to the mediation (14, 29.79%). In other words, the unsuccessful resolution of WL episodes was not necessarily the evidence of pair languages' inability to revise their errors. We further analyzed a proportion of the errors addressed by the teacher-led and Google Docs automated mediations (N = 231, 50% of the total) on both tasks. It was found that 72.89% (N = 189) of the teacher-led and automated mediations targeted the grammar errors and less than 27% (N = 62) targeted the lexical errors, while no mediation was made on discourse marker errors.

5 Discussion

The findings of the study can be summarized as follows:

- (1) The e-collaboration on the form-focused and content-focused writing tasks had differential impacts on the quantity of WL episodes so that the pair languages

Table 5 Pair-wise comparison of the mediation modality and WL resolution

Comparison	Pearson χ^2	p -value	Effect size (Cramer's V)
Teacher-led vs. Resolution	.20	.65	.00
Automated vs. Resolution	.10	.74	.00
Teacher-led vs. Automated	40.69	<.00	.58

who completed the translation task produced more WL episodes than those who completed the data commentary task.

- (2) The e-collaboration on form-focused and content-focused writing tasks caused a similar but disproportional focus of WL episodes on grammar, lexis, and discourse markers. In other words, pair languages focused more on grammar than on lexis and discourse markers while completing both tasks.
- (3) Both teacher-led and Google Docs automated mediation modalities caused a significant number of WL episodes to be resolved by the pair languages on both tasks. However, Google Docs automated mediation had a greater impact than teacher-led mediation on the successful resolution of WL episodes on both tasks.

5.1 Quantity and focus of WL episodes on collaborative writing tasks

Our discussion of the first research question, which explored whether the attributes of WL episodes were affected by the type of focus (form-focused vs. content-focused) in e-collaborative writing tasks is two-fold. Firstly, it was found that the pair languages' collaboration on the form-focused translation task could invoke more WL episodes than the content-focused data commentary task. This finding is anchored in the SCT theory of mind. Vygotsky's (1987) SCT model supports the double impacts of collaboration and languaging on L2 learning improvement. Accordingly, in collaborative languaging, pair languages work together throughout the process of task completion and mutually solve problems (i.e., collective scaffolding). According to Swain (2001), through collaborative languaging, "they recognize a hole in their linguistic knowledge (noticing), formulate and test their hypotheses about how the target language works (hypothesis-testing), and in doing so, consolidate their existing knowledge or co-build knowledge that was new for them" (p. 99). With similar concerns, several researchers speculated that form-focused collaborative tasks actively engage the languages in the deep processing of complex grammatical structures. Such engagement seems less prominent in content-focused collaborative tasks (Hsieh, 2017; López-Pellisa et al., 2021; Tang, 2019; Zhang, 2021).

Consistent with our finding, SLA researchers compared the quantity of WL episodes on different types of collaborative tasks and supported the potential of form-focused tasks to encourage more languaging (Garcia, 2012; Ishikawa, 2018; Niu, 2009; Wigglesworth & Storch, 2009). Coming up with contradictory results, however, Ishikawa (2013) developed a three-stage translation task and required two groups of Japanese EFL learners at higher/lower levels of language proficiency to individually produce WL episodes while completing the task. Ishikawa reported that the lower-level participants produced more lexis-based than grammar-based WL episodes. In contrast, the higher-level participants produced more grammar-based than lexis-based WL episodes. Ishikawa's conflicting results could be due to the participants' self-languaging and absence of collaboration which demanded the lower-level participants rely solely on their existing knowledge of lexis (Purpura, 2014).

Secondly, our findings indicated that the majority of WL episodes were grammar-based (G-WL) on both translation and data commentary tasks. Of critical importance was the CDG pair languageurs' extensive focus on grammar points while completing the assigned data commentary task. As a type of content-focused writing task, the data commentary was expected to enhance pair languageurs' focus on lexical points which it failed to do so. Once again, the underlying reason seems to be the collaborative nature of the tasks which determined the focus of WL episodes on language form. Aligned with our finding, Long (2015) speculated that collaborative languaging on challenging tasks would likely encourage L2 learners to focus on language form(s) and to assist them in revising their written output for accuracy. Our findings corroborate those in Suzuki and Itagaki (2009). In a large-scale experiment, Suzuki and Itagaki required 141 Japanese EFL learners to engage in producing WL while working on a Japanese-to-English translation task and to compare their task outcome with a model translation. Their analysis of WL episodes revealed that grammar-based WL episodes were far more frequent than lexis-based WL episodes due to the form-focused nature of the translation task.

5.2 Resolution of WL episodes by teacher-led and Google Docs automated mediations

Our discussion of the second research question, which explored whether teacher-led mediation and Google Docs automated mediation could have differential impacts on the resolution of WL episodes is also two-fold. Firstly, it was found that both teacher-led and Google Docs automated mediations caused successful resolution of the majority of WL episodes. The high occurrence of resolution in WL episodes could properly reflect the pair languageurs' level of active engagement and intensive noticing of the received mediations (Shintani et al., 2014; Yamashita, 2021). According to Kim and McDonough (2011), collaborative languaging over the teacher and computer-assisted mediations can elevate the L2 learners' level of *mutuality* which causes even more languaging to accomplish the task. Such high mutuality is known as a major step in language learning improvement.

The successful resolutions of WL episodes in this study are in line with the researchers' reports on the instructional role of error feedback in improving writing performance (Falhasiri, 2021; Link et al., 2020; Moradian & Nasab, 2019; Pourdana et al., 2021; Suzuki, 2012). For instance, to examine the effect of written CF on the improvement of 24 Japanese EFL learners' writing task performance, Suzuki (2012) required them to complete a three-stage translation task. The participants produced written self-languaging (i.e., metatalk) over the received CF on their grammatical errors. Suzuki reported a huge number of grammar-based WL episodes produced by the participants which facilitated their writing task achievement. Similarly, Moradian and Nasab (2019) reported

a significant number of resolved WL episodes by EFL learners who received indirect written CF throughout writing five compositions.

Secondly, it was found that the Google Docs automated mediation was more effective than teacher-led mediation in the resolution of WL episodes. In other words, Google Docs seems to play a successful pedagogical role by assisting the pair language learners with synchronous and immediate mediation (Ebadi & Rahimi, 2017; Yamashita, 2021). Consistent with our findings, Bruderermann et al. (2021) argued that incorporating online synchronous mediation into the computer-assisted mini-tasks would increase the accuracy of writing in EFL learners. Zeng and Takatsuka (2009) also required 16 Chinese EFL learners to complete four collaborative writing tasks by producing the chat-based language learning in Moodle online writing course. They reported the large occurrences of WL episodes, and a high rate of resolved WL episodes. Zeng and Takatsuka (2009) suggested that technology-based communication would enhance the L2 learners' attention to the language form and facilitate their social interaction.

Our findings were in partial contrast with those in Kaivanpanah et al. (2020). They compared the nature of teacher and computer-generated mediation modalities in 60 advanced EFL learners' quality of writing on a pretest-posttest research design. The computer-generated mediation was provided by Grammarly and Write & Improve online software. The researchers reported a larger body of teacher mediation than computer-generated mediation (259 to 167, respectively). They also concluded that teacher mediation was responsible for a significant improvement of the higher-level qualities such as content, style, and organization in the student writing. The researchers' observation was in favor of more efficiency in teacher mediation because computer-generated mediation exclusively addressed the lower-level writing features such as grammaticality or word spelling. Our speculation about their findings is that because the participants were required to complete an expository writing task, their writing output demanded the teacher mediation to be more genre-specific and to focus more on textuality or style of writing.

6 Conclusion and implications

In this study, we examined how the attributes of WL episodes would change throughout the EFL learners' collaboration on form-focused and content-focused writing tasks when they were exposed to teacher-led and Google Docs automated mediation modalities. The empirical findings provided strong evidence for (1) the form vs. content focus types in e-collaborative writing tasks and (2) the teacher-led and Google Docs mediations as two major sources in determining the quantity, focus, and resolution of WL episodes.

Several pedagogical implications can emerge from this study. Firstly, the findings vindicate the benefit of collaborative writing tasks if they are improvised with (a)synchronous mediation modalities in CMC platforms. On this account, language teachers are encouraged to develop a variety of form-focused

and content-focused tasks, on which L2 learners can actively collaborate in writing, languaging, and revising procedures. They are also recommended to keep the doors open for oral and written modes of languaging by training the students *how* to language. For more pedagogical benefits, various teacher-imposed languaging tasks can be developed so that languaging is redefined as a task rather than the by-product of a task or a data collection tool (Niu & Li, 2017).

Secondly, by integrating L2 learner collaboration, languaging, and mediation on the CMC interfaces such as Google Docs, Google Meet, or Zoom, teachers can add synchronicity, resourcefulness, and simplicity to the L2 learning environment. The challenges in using advanced technologies in language classrooms can be addressed by revisiting the large-scale educational policies and making “principled decisions to initiate change and to manage the consequence of the change” (Zenouzagh, 2018, p. 2969). Nonetheless, the critical issues of the infrastructure facilities, the speed of the Internet, the quality of the Internet connectivity, the digital divide, and the poor computer literacy of the teachers and students require long-term investment in developing countries like Iran (Rabiee et al., 2013).

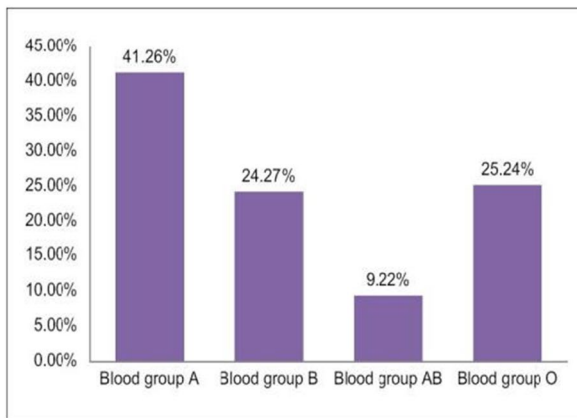
Thirdly, as the literature review indicated, the innovative instructional potentials of Google Docs have been widely supported by several SLA researchers (Ebadi & Rahimi, 2017; Falhasiri, 2021; Marlatt, 2019; Yamashita, 2021; Yang, 2010). In previous studies, however, Google Docs has functioned as a *forum* to facilitate the student-student and/or teacher-student interactions and to create tremendous opportunities to use the target language. Yet, the agency of Google Docs as a *pedagogical tool* has been of little concern to SLA researchers and L2 practitioners. Moreover, by evidence of the findings in this study, one of the observed deficiencies in Google Docs was the limited focus of its automated mediation on the grammatical and lexical errors. So that the errors of higher-level writing qualities such as discourse markers are usually neglected. On this syntax issue, no in-depth technology analysis has been reported to showcase the limitations of Google Docs automated mediation. This complex technological problem urges a collaborative network to conduct advanced research.

The arguments in this study are still tentative due to some ecological and methodological limitations. One of the major restrictions imposed on this study was the COVID-19 pandemic and the lockdowns which pushed countless rearrangements to our communications and follow-up discussions. The next limitation was the non-random purposive sampling method which was carried out to select a large group of advanced EFL learners who were available and willing to participate. Thus, the findings of this study should be applied cautiously to the L2 learners at different levels of enthusiasm, task engagement, or digital literacy. Moreover, we conducted a one-shot comparative study, because we did not intend to examine the long-term impacts of collaborative writing tasks on the attributes of WL episodes. Neither did we plan to manipulate the attributes of WL episodes by including control groups, or by isolating the impacts of the focus types in collaborative writing tasks from the mediation modalities.

Appendix 1

The translation task

COVID-19 and Blood Types



(Adopted from Al-Kheikani, 2020)

Please read the passage and translate it into English (Words limit = 100)

این نمودار گزارش می‌دهد که گروه‌های خونی ABO در حساسیت به COVID-19 نقش دارد. افراد گروه خونی A در مقایسه با گروه خونی O بیشتر در معرض خطر عفونت قرار دارند. درصد گروه‌های خونی O، AB، B و A در کل بیماران مورد بررسی به ترتیب ۲۵/۲۴، ۹/۲۲، ۲۴/۲۲ و ۴۱/۲۶ است. گروه خونی O در مقایسه با گروه‌های غیر O با خطر کمتری همراه است. برعکس، گروه خونی A در مقایسه با گروه‌های غیر A با خطر بیشتری همراه است.

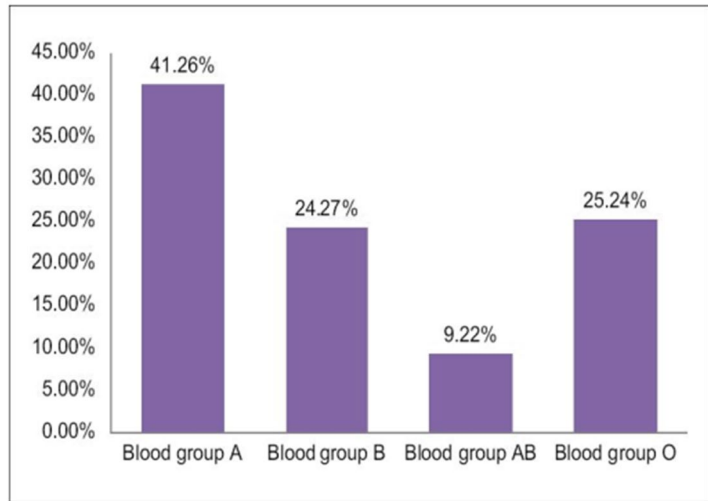
(The model translation)

The figure reports that the ABO blood group plays a role in susceptibility to COVID-19. Individuals with blood type A have a higher risk of infection compared to individuals with blood type O. The percentages of O, AB, B, and A blood types in the total investigated patients are 25.24, 9.22, 24.27, and 41.26, respectively. Blood type O is associated with a lower risk compared to the non-O types. On the contrary, blood type A is associated with a higher risk compared to the non-A types.

Appendix 2

Data commentary task

COVID-19 and Blood Types



(Adopted from Al-Kheikani, 2020)

Write a short report on the data represented in the bar graph (Words limit = 100)

(The model data commentary report)

The figure reports that the ABO blood group plays a role in susceptibility to COVID-19. Individuals with blood type A have a higher risk of infection compared to individuals with blood type O. The percentages of O, AB, B, and A blood types in the total investigated patients are 25.24, 9.22, 24.27, and 41.26, respectively. Blood type O is associated with a lower risk compared to the non-O types. On the contrary, blood type A is associated with a higher risk compared to the non-A types.

Appendix 3

Samples of WL episodes on translation and data commentary tasks

Translation Task		
Translating Stage	Noticing Stage	Revising Stage
People with blood type O Blood O type is better. Blood type O group? Yes. Blood O type group faces less risk. Face or faces? Faces I think. Less ¹ risk or risks? No, I am sure it is risk. Google says fewer Blood O type group faces fewer risk. Why Google says it is wrong? It says The blood type is correct. OK. The blood O type group faces fewer risk.	The blood O type group ² faces fewer risk. What is wrong with group? It must be groups? No. It can't be groups. Google said nothing about it. Yes. I don't know what should we do about it. Maybe The group with blood type O? Then it must be about grammar and it must be highlighted yellow! Yes. What about fewer risk? Google said fewer. Yes. I think it must be plural. Fewer risks? Yes.	The group with blood O type face fewer risks. The blood O type group faces fewer risks. It seems fine! I think Google accepts it, so it is correct. Yes, but what is really incorrect about group? I think our sentence is correct anyway. OK.
Data Commentary Task		
Reporting Stage	Noticing Stage	Revising Stage
41.26% of the COVID-19 patients have blood type A. Good. And 24.27% have blood type B. Let's say them together. 41.26% of the COVID-19 patients have blood type A and 24.27% have blood type B. Yes. What about but? 41.26% of the COVID-19 patients have blood type A, but 24.27% have blood type B. 24.27% of the patient? And was OK.	41.26% of the COVID-19 patients have blood type A and 24.27% of the patient have blood type B. See? It should be but! Yes, but is better. What should we make to have? Got? Had? Oh! Past form of have. Chera? ³ It must be past. Ok. Patients Yes.	41.26% of the COVID-19 patients had blood type A but 24.27% of the patients had blood type B. So both have's must become had. And must become but. Or however? Yes. However is OK too. However can come first. No I don't think. Why Google highlighted it? It is not important, I think. OK. So we change it to however.

¹ Google Docs mediation (waved underline)

² Teacher mediation in Yellow (on grammar); in Blue (on lexis); in Red (on discourse);

³ L1 written languaging (= Why)

Note: The pair languagers chose the blue and black font colors in Google Docs.

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Authors and Affiliations

Pooneh Kazemi¹ · Natasha Pourdana¹  · Gholamhassan Famil Khalili¹  · Payam Nour² 

Pooneh Kazemi
pooneh.kazemi@gmail.com

Gholamhassan Famil Khalili
khalili@kiau.ac.ir; familkhalili@yahoo.com

Payam Nour
p.nour@edu.ikiu.ac.ir

- ¹ Department of English Language Teaching and Translation, Karaj Branch, Islamic Azad University, Moazen Boulevard, Gohardasht, Karaj 31485-313, Iran
- ² Department of English Language, Faculty of Humanities, Imam Khomeini International University, Qazvin, Iran