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Chapter 11

Intelligent CALL Systems for Writing Development: Investigating the Use of Write & Improve for Developing Written Language and Writing Skills

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ABSTRACT

Technological innovation in supporting feedback on writing is well established in computer-assisted language learning (CALL) literature. Regarding writing development, research has found that intelligent CALL systems that respond instantly to learners' language can support their production of better-written texts. To investigate this claim further, this chapter presents a study on learner use of Write & Improve (W&I). The study, based on learner engagement with W&I and learner and teacher surveys and focus groups, demonstrates that learners find W&I to be engaging and motivating. Moreover, there is evidence of improvements in learner writing practices and written language proficiency. For teachers, W&I can render feedback more efficient, allowing them to focus on more complex aspects of learner texts, while spelling and syntactic accuracy are addressed by W&I. Issues also emerge in the use of W&I, which present problem areas for teachers and learners and which signal important future considerations for CALL research.

INTRODUCTION

Giving feedback to learners to help them to develop both written language (i.e., the language they produce) and writing skills (i.e., the strategies they use to produce writing) is a core facet of language

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teachers' professional lives (Hyland & Hyland, 2006; Nassaji, 2020). Technological innovation in supporting this practice is well-established in the literature on computer-assisted language learning (CALL) (cf. Frankenberg-Garcia, 2020), and in the context of writing development, research has found that intelligent CALL systems that can respond instantly to learner language can support the production of better writing output by learners (Tschichold & Schulze, 2016). Such writing technologies that involve learners practicing their writing online and in their own time are particularly pertinent for supporting learner autonomy and self-led online writing development (Ghufron & Nurdianingsih, 2019).

Building on the relevance of such feedback and accuracy development technologies to language production, the field of CALL has seen an increase in the use of data-driven learning technologies that combine language data, language models, and pedagogical theories on feedback and language learning to inform their development. Collocaid, for example, takes a feed forward approach to developing learner knowledge of collocational patterns in academic language by using corpus data to suggest collocations and sentence patterns that learners might not have considered in their writing (Frankenberg-Garcia, 2020). A similar corpus-informed project, designed to give feedback on academic writing, is the BAWE QuickLinks project. This project uses Sketch Engine links to sanitize concordance searches of the British Academic Written English corpus (2008) that direct learners to language models for addressing language errors identified in their written work (Vincent & Nesi, 2018). SKELL (Sketch Engine for Language Learning; Lexical Computing, 2019) is another technology of note that allows for word searches, synonym checks, and collocation analysis. Lexical Computing (2019) reports that SKELL is “a state-of-the-art cloud tool for building, managing and exploring large text collections in dozens of languages. It is used all over the world by many individuals, as well as companies such as Cambridge University Press, Oxford University Press and Macmillan.” Each of these technologies offers different means of engagement and insights to their users. Collocaid feeds forward and avoids corrective feedback, BAWE QuickLinks offers corpus-based feedback with example sentences based on errors, and SKELL is a reference technology used to check how language items are used. This study is based on Write & Improve (2020), which, unlike these other technologies, offers corpus-informed automated and corrective feedback.

Write & Improve uses machine-learning technology and data from the 30-million word error-annotated Cambridge Learner Corpus (Cambridge University Press & Cambridge Assessment, 2020) to identify errors in learner written language. The technology identifies errors for which it is 90% certain and, owing to its design, uses input data from learners on an ongoing basis to further inform its identification of error patterns (Write & Improve, 2020). This technology can determine the level of learners' language, benchmarked against the Common European Framework of Reference (CEFR), and it delivers summative feedback, indirect and formative feedback, and progression feedback on learners' writing. The technology seeks to guide learners to notice and address language errors, while facilitating learner autonomy and engagement. Typically, students can respond to writing tasks that reflect Cambridge English language examinations or tasks set by their teacher, who can create virtual classrooms and workbooks for their students. Students work in their own time and receive automated feedback from the technology. A major benefit of this is that students can gain feedback in a non face-threatening (Brown & Levinson, 1987) environment, which can lessen the anxiety they feel during feedback, and in turn, lower the Affective Filter (Krashen, 1985) in order to enhance the learning experience. There is also space for teachers to manually add feedback, and, as a result of this type of feedback mechanism, motivation is also heightened (Golonka et al., 2014).

This study of Write & Improve centers on its use by learners as an online writing development technology. Learners used it in their own time to develop their own writing, and the study aimed to determine

how learners engage with Write & Improve's feedback and to determine what impact Write & Improve has on their writing development. It also aimed to identify teachers' perceptions of their learners' use of Write & Improve and to determine how learner use of Write & Improve impacts, if at all, the teachers' practices. To achieve these aims, a study was conducted in two universities in Turkey that used Write & Improve for all written exercises over a six-week period. First, learners and teachers were surveyed before engaging with Write & Improve in order to understand clearly learners' approaches to writing and teachers' approaches to writing development. Second, after having begun to use Write & Improve, user-data were extracted in order to gain an oversight of the learners' engagement with the learning technology. Finally, focus groups were conducted with learners and teachers, and post-study surveys were completed in order to access attitudinal data surrounding Write & Improve.

To present and substantiate this study, the literature on intelligent CALL systems for writing development is considered, positioning this study among contemporary research in the field. Subsequently, a methodological overview of the project is presented, outlining both the participant data and methodological processes in more detail. Following that, the results of the study are considered, reflecting the aims of this research. Finally, a conclusion is presented to summarise the findings of this study, its relevance to the current volume, and directions for future research in this area.

LITERATURE REVIEW

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The literature on intelligent CALL (ICALL) systems reflects a dynamic and evolving canon. In the specific context of writing development, ICALL systems such as Collocaid (Frankenberg-Garcia, 2020), BAWE QuickLinks (Vincent & Nesi, 2018), SKELL (Lexical Computing, 2019), and Write & Improve (Write & Improve, 2020) demonstrate a diverse range of recent and emerging technologies used to support and enhance writing development. ICALL systems are understood to be intelligent learning systems, which often have very specific roles and have been designed with very specific purposes and theoretical underpinnings (cf. Monfared et al., 2018). As such, it is important to consider how ICALL systems fit within broader ecosystems of learning by considering their role in engaging and motivating learners, in developing learner language and writing skills, and in supporting teachers' practices.

In ICALL system studies, learner engagement and motivation are among the most espoused advantages of using technology for writing development (Golonka et al, 2014; Shadiev & Yang, 2020). Motivation and engagement are particularly realizable when learners have access to personalized feedback and support (Yu, Jiang, & Zhou, 2020) and therefore, motivation and feedback are intrinsically linked. While motivation can be negatively impacted by ICALL systems that do not demonstrate sufficient reflexivity and that do not offer learners multiple means for engagement (Gao & Ma, 2020), ICALL systems typically facilitate both intrinsic and extrinsic motivation in a number of ways. ICALL systems have been found to support intrinsic motivation through engaging learners with social media, for example, which can foster feelings of interest and enjoyment for learning (Alberth, 2019). To support extrinsic motivation, ICALL systems can make use of learning objectives and gamification, for example (Calvo-Ferrer, 2017). Such a view places an importance on motivation and engagement, which have been found to be key in encouraging learners to redraft their written work in the context of ICALL systems and writing (Zhang, 2020). Overall, ICALL systems' links to motivation and feedback are important, as, generally,

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the role of motivation in language learning has become paramount where active engagement, processing, and actioning of feedback can support learners in their own personal development (Cunha et al., 2019) and the development of their confidence, especially in the context of writing (Tsai, 2019). Therefore, in the case of Write & Improve, it is worth investigating how it addresses the issue of learner motivation and whether or not this motivation is operationalized to support language development.

Engagement with ICALL systems has been found to support not only motivation, but also language learners' writing development (Allen et al., 2014). Studies in this area reflect a key value of ICALL systems for language learning. These include Zhang (2020), who documents the development of an effective writing process through ICALL systems, and Castaneda and Cho (2016), who identify that automated error correction and feedback can help learners to internalize and compound new and previously learned material. Typically, ICALL systems have been most effective at supporting error correction and feedback for syntactic, grammatical, and lexical errors (Choi, 2016). For example, typical English language writing errors identified in learner corpus studies, such as spelling and punctuation in Curry and Clark (2020), have been the focus of ICALL systems research elsewhere. Both Lawley (2016), who identifies the value of language learner specific spell checkers to support learning, and Shang (2016), who combines peer-feedback with the software CorrectEnglish to address issues of punctuation, among other errors, reflect this focus. This type of automated error correction in particular has been welcomed by learners (Castaneda & Cho, 2016), who can find excessive corrective feedback from teachers to be discouraging (Ryan & Henderson, 2018). It is important to note that in order to offer any chance of impact, the corrective feedback issued by ICALL systems must be well scaffolded and actionable (Pollard, 2018). Overall, the benefits of such guidance and feedback is well established in the literature with evidence that ICALL systems for writing development can foster the development of key metacognitive strategies, such as self-evaluation, which in turn can foster the growth of self-confidence in learners (Mehri Ghahfarokhi & Tavakoli, 2020). Therefore, as a continually growing field, it is important to understand what aspects of ICALL systems are particularly pertinent for facilitating learning.

From teachers' perspectives, ICALL systems for writing development have received a mixed response. Following Lu (2019), automated writing evaluation appears to be favorable to both learners and teachers. For teachers, the motivating nature of ICALL systems for writing development is noteworthy, as is the clarity of feedback certain technologies provide as well as the timesaving support they can offer. However, Lu also documents the need for further development, of ICALL systems for writing development where teachers critique their lack of capacity to address issues of discourse in a text. Stockwell and Reinders (2019) similarly identify that while ICALL systems can afford teachers many opportunities to support and inform their practice, a lack of training, poor digital literacy, and a lack of institutional support can inhibit the efficacy of such systems. Elsewhere, teachers have found the degree of explicitness and generality of feedback to be important, with more general feedback typically being ambiguous and often resulting in learners failing to address their mistakes (Ranalli, 2018). While the ambiguity of feedback in certain cases can result in a missed opportunity for ICALL systems and return the burden to the teacher, it is argued that the students' engagement with the feedback and how this can assist the writing process should be more important than the feedback itself (Zhang, 2020). Teachers have also been found to develop greater awareness of their feedback practices through their use of ICALL systems, where feedback can be offered at an earlier stage of writing, thus allowing teachers to provide more focussed feedback to learners at a later stage (Stevenson, 2016). Interestingly, while such an approach may intuit that teachers can devote more time to complex feedback, with the ICALL systems addressing sentence-level issues, this intuition has not been corroborated elsewhere (Mehrzaad & Rahimi, 2020).

Overall, the literature makes clear that as a fast-paced field, ICALL systems research offers many avenues in need of further elaboration. There is clear evidence that ICALL systems can facilitate motivation. Moreover, their value of language learning and development is well established, and from teachers' perspectives, ICALL systems also offer opportunities for saving time and supporting their delivery of feedback to learners. However, what remains unclear is how the Write & Improve technology is situated among ICALL systems. Among the many critiques that exist of technologies for language learning is their aim to transfer knowledge to learners with little consideration given to their pedagogical underpinning (Volika & Fesakis, 2018). It is important not only to consider, then, whether or not a technology is motivating for learners, but whether it facilitates learning of language and skills. Finally, while there is evidence to support the use of ICALL systems by teachers, this evidence appears inconsistent, with ICALL systems often being critiqued for their inability to address teachers' needs. Therefore, it is worth both unpacking how teachers engage with Write & Improve and uncovering the facets of this technology that teachers find useful, as well as those that they consider a shortcoming.

METHODOLOGY

An Overview of the Project: Data and Methods

Write & Improve uses technology developed at the University of Cambridge to give feedback on English writing. The technology allows learners to submit work which is then scored according to the CEFR scale. It also highlights parts of the learners' text that might need improvement, with the aim of encouraging noticing and redrafting. According to Write & Improve (2020), the ICALL system works through:

- machine learning based on an algorithm developed by iLexIR;
- being fed *training data* from the 30-million word error-annotated Cambridge Learner Corpus (Cambridge University Press & Cambridge Assessment, 2020);
- 'learning' to spot the same errors and patterns of error in any future L2 data that is fed into it;
- the annotation team annotating the data and feeding it back into the pipeline;
- only flagging up possible errors when it is more than 90% certain it is right;
- being carefully calibrated not to give too much feedback in one go, and
- 'speaking' learner English.

This chapter presents findings from a study on the use of Write & Improve in two Turkish universities. The overarching aim of the study was to address the following research questions (RQs):

RQ1: How does Write & Improve impact the motivation of learners to write in English?

RQ2: How does Write & Improve impact learners' writing behaviours?

RQ3: To what extent does Write & Improve advance learners' language?

RQ4: How does learners' use of Write & Improve impact teachers' practices?

To answer these research questions, the following data collection tools were implemented: (a) surveys, (b) Write & Improve tasks and user data, and (c) focus groups.

Table 1. No. of participants in the study per research instrument

Data Collection Tool	No. of participants
Write & Improve use by learners	140 learners
Learner Pre-study survey	134 learners
Learner Post study survey	97 learners
Teacher Pre-study survey	4 teachers
Teacher Post study survey	4 teachers
Learner focus group (post-study)	30 learners
Teacher focus group (post-study)	8 teachers

The study was conducted over a six-week period during a 12-week pre-session course. First, online surveys for teachers and learners were administered before and after learner use of Write & Improve. These were translated into Turkish for the learners. The surveys aimed to address motivations and behaviors of learners and teachers with regard to writing. Questions in both surveys were similar in order to allow for comparisons over time, although the post Write & Improve survey asked more direct questions about Write & Improve. Second, learners were given two tasks per week on Write & Improve, over the course of the six weeks. These tasks included essays, reviews, letters, extended definition stories, emails, proposals, reports, notes, and reflections of personal and emotional experiences. The data from Write & Improve were analyzed for learner engagement, score improvement, and the errors identified. Finally, focus groups with learners and teachers at each institution were conducted in order to understand the survey data better and gain more in-depth insight into their perceptions of the impact of Write & Improve. These focus groups were conducted post study and in person in Turkey. Table 1 shows the total number of participants who engaged with each instrument in this study.

FINDINGS

Write and Improve and Writing Development

In order to address the aims and research questions that have guided this research, this section is subdivided to consider the data extracted from the learners' use of Write & Improve and the additional information gleaned from the analysis of surveys and focus groups. In terms of Write & Improve data, first, this study presents the analysis of learner engagement with tasks which illustrates how motivating and engaging Write & Improve appeared to be for learners. Second, learner CEFR levels and CEFR level increases are discussed to investigate learners' writing development from a linguistic perspective. Third, learner errors are presented with a view to identify how Write & Improve addresses learner errors. With regard to the survey and focus group data, the analysis and discussion offers insights into motivation, writing skills, practices and behaviors, and attitudes toward Write & Improve.

Learner Engagement, Levels and Errors in Write and Improve

Learners exhibited a range of engagement patterns with Write & Improve, with the 140 users using it 7,568 times over a 6-week period. This means that each user, on average, used Write & Improve 56 times over the course of the study, or nine times per week. Given that there were only two writing tasks per week, it is clear that learners used Write & Improve multiple times for each piece of writing they completed. This initial bird's-eye view offers clear evidence of high levels of learner engagement with Write & Improve's instant feedback, corroborating existing claims within the literature that "writing motivation [is] most significantly correlated with...feedback-seeking orientation" (Yu, Jiang & Zhou, 2020, p.2).

Zoning in on task engagement, the analysis sought to identify the number of attempts or drafts that the learners submitted for each task. It was deemed important to explore whether each learner had more than one attempt per task and whether these further attempts were immediate (as the program offers instant feedback in order to encourage self-correction) or delayed, with learners returning to the program at a later time or date. The latter might be an indicator of the learners' attempts at using automated feedback and error correction for redrafting (Zhang, 2020) while overall engagement with multiple tasks can evidence higher levels of learner motivation (Gao & Ma, 2020).

Overall, multiple learners attempted each writing task multiple times. At the lower frequency of attempts, 23 individual learners attempted individual tasks just once. At the higher end, an individual learner attempted an individual task 151 times. The median level of engagement per task is 40 attempts per learner. As these Write & Improve tasks represented writing homework for the learners, this can be understood as a learner redoing their written homework up to 151 times and at a median of 40 times, based on automated feedback. This reflects substantial levels of engagement and motivation among many learners and an active engagement with feedback (Cunha et al., 2019), where learners were actively using feedback to improve their written homework. Furthermore, when examining attempts made over time, in the majority of cases the learners made immediate corrections and submitted their second (or later) attempt instantaneously. However, some learners returned to their tasks over a number of hours and/or days, which suggests that as well as encouraging self-correction and the noticing of errors, this ICALL system potentially encourages the process of redrafting over a longer period of time.

In order to identify whether learners' writing ability developed over the course of this study, Write & Improve data, benchmarked against the CEFR and learner corpus data, were available to study. Tracking score change over time, it was deemed appropriate to examine the score difference between the first attempt of the first task and the first attempt of the last task for each learner. This ensured that the analysis centered on learners' original written text and not texts improved based on Write & Improve feedback. Overall, 78% of learners increased their writing proficiency from their first to last task, with 12.5% remaining the same and 9.5% attaining a lower CEFR level in their written performance. For those who increased in proficiency, the most frequent level changes were from B1 to B2 and B1 to C1. The evidence of level change is encouraging and reflects a key value of Write & Improve for supporting language development. This is particularly noteworthy and reflects broader research on ICALL systems which finds that automated feedback can directly influence language learning (Castaneda & Cho, 2016). However, it must be noted that while learner use of Write & Improve in this study reflects a substantial increase in language levels, the levelling is related to the writing of a specific task and is based on accuracy as well as grammatical and lexical complexity. Therefore, it is not a reliable test for definitively determining learner levels. Rather, the levelling is indicative of the grammatical and lexical accuracy

Table 2. Total errors identified

Total distinct errors	Total error identified	Total distinct errors	Total error identified	Total distinct errors	Total error identified	Total distinct errors	Total error identified
S	693	IN	68	L	16	CE	4
RP	313	AGV	65	RY	16	RA	4
+MD	295	SX	61	AGQ	16	IY	3
MD+	289	FV	60	DA	13	IA	3
RT	210	FD	58	RQ	13	AGA	2
MP	208	FN	44	UC	13	MT	2
UT	184	DV	44	+MC	12	+M	1
CN	157	DN	37	MC+	12	M+	1
DJ	153	DY	31	W	10	MA	1
UD	110	UP	28	+MA	9	UQ	1
+MT	99	RJ	24	MV+	8	RD	1
AGN	98	DD	22	+MV	6	DI	1
IV	92	RN	21	MP+	5	ID	1
RV	85	MA+	20	+MQ	4	X	1
MT+	85	U	19	UY	4	UA	1
UV	79	MD	18	+MP	4	DT	1
AGD	72	R	17	CQ	4		
TV	71	IJ	17				

and complexity typical of a CEFR level and can allow for the determination of changes in linguistic writing ability within Write & Improve from task to task.

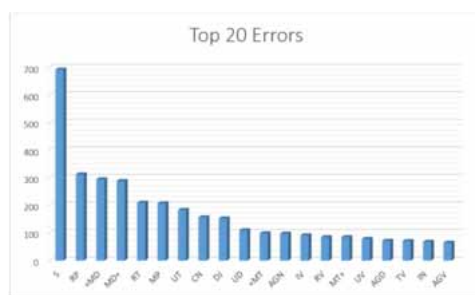
In terms of error correction, 69 individual types of errors were identified. Table 2 lists them in order of frequency and according to their error code in Write & Improve.

Overall, there were 4,140 errors identified, on which feedback was delivered. A key for error codes is available at http://www.cambridge.org/sketch/error_codes.html and in Appendix A. The top 20 most frequent errors identified for this study by Write & Improve are shown in Figure 1.

The four most frequent errors were of a mechanical type and included spelling (S), replace punctuation (RP) and a more grammatical type including missing determiner (MD) and replace preposition (RT). These are typical errors in EFL/ESL learner writing (Curry & Clark, 2020). The remaining errors, in order of frequency, included missing punctuation, unnecessary preposition, countability of noun error, derivation of adjective error, unnecessary determiner, missing preposition, noun agreement error, incorrect verb inflection, replace verb, unnecessary verb, determiner agreement error, incorrect tense of verb, incorrect noun inflection, and verb agreement error.

Using the Cambridge Learner Corpus (Cambridge University Press & Cambridge Assessment, 2020), it is clear that the errors found in this current study are among those most frequently made by Turkish learners of English. Table 3 offers the top 20 most frequent errors as identified in the Cambridge Learner Corpus by Turkish learners of English (the error is underlined and a corrected version is in square brackets).

Figure 1. Top 20 errors by learners



Fifteen of the 20 error types highlighted in Figure 1 and Table 3 are common to the Write & Improve data and the Cambridge Learner Corpus data. Therefore, the participating learners are making errors typical of Turkish learners of English. Having information on the errors that learners make can offer rich insights into the learners’ interlanguage, which could then be used to inform future teaching and/or

Table 3. Top 20 errors in Turkish data of Cambridge Learner Corpus

No.	Error	Example and [correction]
1	Replace Punctuation	Then when I got out of the house,I saw it was sunny and my parents were playing paintball. [comma]
2	Missing Determiner	We will study lesson and play football [our]
3	Missing Punctuation	On the other hand we are in the 21st century. [,]
4	Spelling	Beacouse [because]
5	Incorrect Tense of Verb	They are given to us for safekeeping for future generations. [were]
6	Replace Verb	Dear Ms Evans, I would like to tell my opinion and suggestions about this notice ... [give]
7	Replace Preposition	A learner club which is managed by learners at the ages of 13 and 20 who would like to ... [between]
8	Unnecessary Punctuation	... was too hard to go to the living room and watch T.V. [TV]
9	Missing Preposition	If you would like to lend it me, I'll return it on Monday. [to]
10	Replace Noun	... it is like learning a mother language: children pick up the words and use them. [tongue]
11	Unnecessary Determiner	The kind of concert is a rock. [zero article]
12	Wrong Phrasing	... with jobs are really helpful and aware that they need to improve their English and get good ... [the learners]
13	Missing Verb	It is from 7 am to 9 pm. I not sure what we are supposed to ... [I'm]
14	Word Order	... tell me more about the organization, like how big is it or what kind of work you do there to save ... [it is]
15	Wrong Verb Form	... bad effects of both men and women have jobs outside the home, it makes all ... [having]
16	Unnecessary Preposition	What about could you bring on the day? [delete about]
17	Wrong Noun Form	When I was seated, the women next to me started shaking. [woman]
18	Missing Anaphor	I closed my eyes and opened in the hospital. [them]
19	Verb Agreement	If all the world speak the same language, everybody will maybe ... [speaks]
20	Replace Adverb	It could be so late. [too]

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remedial work (Dolgova & Mueller, 2019). Overall, the error identification in Write & Improve supports an automated approach to corrective feedback and accuracy development in a personalized manner. The quantity of errors identified and consistency with which they are identified reflects a recognized strength of automated feedback technology (Choi, 2016). However, the errors identified are limited to syntactic, grammatical, and lexical accuracy, and therefore it is clear that the ICALL system does not respond to contextual and pragmatic errors in meaning, a critique of ICALL systems raised by Choi (2016).

The data drawn from Write & Improve has shown that user engagement was high across task types. The ICALL system predominantly fostered error correction, whereby learners made multiple attempts at improving their work. Though less frequent, it could also be seen to encourage a more delayed process of refining and redrafting. Furthermore, the majority of learners increased their CEFR level over time and Write & Improve offers particular support with error correction at the level of syntax, grammar and vocabulary. Building on this analysis, the learner and teacher survey and focus group results are discussed in the following sections.

Learners and Teachers on Write & Improve

Focusing initially on learners, the survey data and focus groups are analyzed. In so doing, consideration is given to learner motivation, behaviors, writing practices and perceptions of Write & Improve. Subsequently, the teacher data is considered to better understand teacher perceptions of Write & Improve and the impact it had on both learner and teacher practices from teachers' perspectives.

The first question on the pre and post-study survey for learners focused on motivations (intrinsic/extrinsic) and perceptions of writing in English. It referred to enjoyment, effort, and feelings about English writing and prompts were offered requiring a response in the form of a Likert scale. The second question on the pre and post-study survey for learners was also a Likert scale and focused on learning behaviors. This was concerned with learner agency, roles, and practices and asked learners to reflect on their writing practices, relating to feedback, process, and technology. Table 4 shows the differences (increase + or decrease -) in learner pre and post-study surveys for the combined answers of 'agree' and 'strongly agree' for each of the statements in question one.

According to the survey data, there is a notable increase and reported improvement in a number of areas. After the 6-week study, learners reported feeling more excited about English and were increasingly looking forward to English writing class. More learners found English writing interesting, felt as though they were doing their best to improve, and felt that they could express themselves well in English. Furthermore, an increasing number of learners reported that English writing is fun, and that they were prepared to put a lot of effort into improving their writing in English, which reinforces earlier findings on drafting and multiple submissions. The emotional response to writing in English with affective considerations such as the excitement of, looking forward to, interest in, and the fun of writing reflect clear intrinsic motivations to learn (Alberth, 2019). Interestingly, this motivation increased over the course of the 6-week study. Extrinsically, learners' work ethic, with their willingness to put in effort and do their best to improve, demonstrates their increased extrinsic motivation. This is known to be linked to learners' ability to visualize their improvement (Calvo-Ferrer, 2017), a feedback feature of Write & Improve which outlines progress with graphs and scores on the learner dashboard.

Learners also exhibited a decrease in finding writing difficult and stressful, which is a positive finding, reflecting increased learner enjoyment of writing. This is consistent with Cunha et al. (2019) and Tsai (2019), who found that automated feedback on writing can help learners to gain confidence while

Table 4. Learner pre and post study survey question one

Prompts	%increase/decrease
I get excited about writing in English.	+19%
If I make an effort, I am sure I will be able to master writing in English.	-6%
I always look forward to English language writing class.	+17.5%
I find writing in English difficult.	-2.5%
I am working hard to improve my writing in English.	+3%
Writing in English is stressful.	-9.5%
I find writing in English interesting.	+10.5%
I think I am doing my best to improve my writing in English.	+18%
I feel I can express myself well in written English.	+11%
I find writing in English fun.	+15.5%
I am prepared to put a lot of effort into improving my writing in English.	+11.5%
If I had to write in English, I would feel nervous.	-2%

developing their writing. While many of the remaining prompts reflected only marginal increases and decreases, interestingly, fewer learners felt that they will master English post study. This may be owing to Write & Improve consistently highlighting errors in their work, as such corrective feedback has been found to foster perceptions that language mastery is unachievable (Ryan & Henderson, 2018).

For question two, the aggregate of pre and post-study results for ‘agree’ and ‘strongly agree’ are presented in Table 5.

Overall, post study, learners exhibited more positive reactions to almost all the prompts, with only two showing a negligible decrease. More learners felt that they were learning when writing in English and use feedback to improve their written texts. These increases reflect a development in the metacognitive and self-regulation strategies of the learners. That is to say, the self-evaluation of learning and active engagement with feedback are valuable outcomes, as the use of such metacognitive strategies is known

Table 5. Learner pre and post study survey question two

Prompt	%increase/decrease
My English language classes place importance on learning writing.	-2%
I get to write about things that interest me.	-1%
I get to write about things that are relevant to me.	+2%
I feel I am learning when writing in English.	+3.5%
I plan before starting to write in writing tasks.	+16%
I write multiple drafts of writing texts.	+16%
I use feedback to improve my texts.	+18%
I can edit my own work for accuracy.	+7%
I get useful personalised feedback from my teacher.	+20%
I get regular feedback to improve my writing in English.	+8%

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Table 6. Learner post study survey question three

Prompt	%agree/strongly agree
Write & Improve helps improve my writing in English by helping me eliminate errors.	83.50%
I wish I used Write & Improve more for homework on writing practice to help me notice my errors.	87.72%
I find Write & Improve useful for improving my writing generally.	85.64%
I find using Write & Improve for writing in English makes writing more fun.	73.64%
I find using Write & Improve an enjoyable way to improve my language if the feedback is not negative.	75.34%
I use Write and Improve to work on my writing in English to help me notice and eliminate errors.	81.47%
I get useful feedback on my English language writing from Write & Improve.	85.86%
I find feedback from Write & Improve useful in improving my writing in English.	79.98%

to directly and positively impact language learning (Mehri Ghahfarokhi & Tavakoli, 2020). Furthermore, the notable increase in learners planning, drafting, and editing their texts reflects an improved engagement with the writing process, which drafting ICALL systems have been known to develop (Zhang, 2020). Finally, the findings of the survey also validate existing literature on automated feedback, indicating that learners consider useful feedback as a means to improve their writing (Castaneda & Cho, 2016). However, the learners also showed an increase in the personalized nature of feedback they received from teachers, which is an important finding of this research and reflects Stevenson's (2016) work on combining teacher and automated feedback.

With specific regard to Write & Improve, Table 6 presents the findings from the additional question posed to the learners. This question was asked in the post study survey in order to gain insight into learner engagement with and perceptions of Write & Improve.

Learners showed extremely positive reactions to Write & Improve's support for eliminating errors, for helping them to notice errors, and for improving their writing. They also found it fun and enjoyable, and they found the feedback it offers to be useful. Overall, these findings reflect a high level of learner positive engagement with Write & Improve, demonstrating the perceived role of the ICALL system in improving motivation for learning (Golonka et al, 2014; Shadiev & Yang, 2020) as well as linguistic output (Castaneda & Cho, 2016). Building on this post-study survey, focus groups were conducted with learners to better understand their engagement with Write & Improve.

Overall, five focus groups with learners were conducted which centered on learners' impressions of Write & Improve, the feedback it gives them, and their writing process. There were 30 learners involved in the focus groups. The learners largely reported enjoying using Write & Improve, as seen in the survey data. They saw a value in it and often preferred to get feedback from the ICALL systems than from their teachers. This was due to the self-reported sensitive nature of getting feedback. For the students, getting feedback from a piece of technology was more accessible and less stressful. This raises an interesting point concerning affective approaches to feedback whereby learner sensitivity in receiving feedback has been found to limit their engagement with it (Ryan & Henderson, 2018). The learners saw value in being able to draft and redraft their writing and get corrections before submitting texts to their teacher, which reinforces findings from the survey data. In speaking to learners, their feedback is quite consistent and not complex. In essence, the learners liked using Write & Improve. They did, however, have some reservations, as discussed below.

Table 7. Teacher pre and post study survey question one

Prompt	%increase/decrease
I think feedback should be critical.	+25%
I think feedback should be direct.	unchanged
I think feedback should be encouraging.	unchanged
I try to give direct feedback to my learners about their writing.	unchanged
I give regular feedback to learners on their writing in English.	unchanged
I try to give encouraging feedback to my learners about their writing.	+25%
I give group feedback to classes on their writing.	-25%
I give individual feedback to each learner on their writing.	+25%
My classes are too big to give sufficient individualised feedback to learners on their writing.	unchanged
I try to give critical feedback to my learners about their writing	unchanged
My learners' writing improves after feedback	+25%
My learners would like to use technology when doing their homework	-25%

First, the learners found that the feedback was, at times, ambiguous. When they brought their work to class to discuss with the teacher, it was not always clear what the error was. This was often due to the highlighting of text that did not contain errors but did contain language that was unambitious and not complex. Write & Improve can highlight such elements of text to encourage learners to be more elaborate with their language. The ambiguity, however, led learners to question the accuracy of their writing. This ambiguity is important to note, as ambiguous feedback can negatively impact learner development because it offers little guidance for learning and improvement. Therefore, ambiguity in feedback, such as that identified by Ranalli (2018), poses a real problem for learners using Write & Improve. Second, the learners noticed that in terms of CEFR level, rising to a higher level was a rather quick process, which could involve learners increasing several levels at a time. As such, they felt that their own levels had not progressed in line with Write & Improve's evaluation. This seemed to be a problem of messaging, where the CEFR level that Write & Improve attributes to a learner is not a validated assessment but an approximate level based on criteria for a specific task and skill. This, however, caused learners to lose some confidence in Write & Improve. These issues notwithstanding, overall student perception of Write & Improve was extremely positive and they felt it allowed them to develop their writing process. Moreover, they found it enjoyable to use, from a learner perspective. Next, teacher perspectives are considered, with evidence from the teacher survey and focus groups.

The first question on the pre and post-study survey for teachers dealt with feedback and its role in their teaching, while the second question focussed on teachers' feelings towards technology and its value for giving feedback. Question two was part of the post-study only, allowing for a specific focus on Write & Improve. Table 7 shows the differences in pre and post-study surveys for combined answers 'agree' and 'strongly agree' for each of the prompts. As can be seen, many items remain unchanged.

While there were often no changes in the teachers' perceptions about feedback over the course of the study, there was nevertheless an increase in a number of areas. More teachers felt feedback should be critical, tried to give encouraging and individual feedback to their learners, and more teachers believed that learners' writing can improve after feedback. These changes in feedback practices reflect findings

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Table 8. Teacher post study survey question two

Prompt	%agree/strongly agree
I encourage learners to use Write and Improve to monitor and improve their own writing.	100%
I think that Write and Improve is good enough to give useful feedback to learners on their language use.	25%
Using Write and Improve is valuable when getting learners to write in English at home.	100%
I encourage my learners to use Write and Improve to notice their errors in English.	50%
Using Write and Improve is an effective way to support learners when developing their writing in English at home.	50%
Write and Improve gives learners personalised and individualised feedback on writing and replaces the need for a teacher.	0%
Write and Improve gives learners personalised and individualised feedback on writing and frees up teachers' time to focus on different areas.	100%
Write and Improve gives learners personalised and individualised feedback on writing but is more valuable as a homework technology, and is not likely to be used in a classroom.	25%
I think automated feedback from Write and Improve can improve writing.	100%
I don't trust Write and Improve to give my learners accurate individualised feedback on their writing.	0%
I can see the advantage of Write and Improve in supporting learners when working on English at home.	100%
I would like to use Write and Improve more to support learners' writing.	100%

from the literature surrounding feedback literacy, whereby teachers' understanding of feedback can have a direct impact on its value for language learners (Stevenson, 2016). Interestingly, fewer teachers gave group feedback, likely owing to Write & Improve addressing many of the syntactic, grammatical, and lexical errors that learners made. Fewer teachers also believed that learners would like to use technology when doing their homework. This view is somewhat at odds with learners' reporting on the use of Write & Improve. From the focus groups with teachers, the challenges teachers perceived with learner use of Write & Improve was the occasional ambiguity of the feedback, which often led to teachers needing to unpack the feedback for the learners. This is a well-recognized shortcoming of automated feedback technology (Ranalli, 2018), but could be viewed as a means of encouraging more teacher input and discussion after automated error detection. This could support their delivery of a more fine-grained feedback process for the learners.

For the second question, the results for combined 'agree' and 'strongly agree' responses can be seen in Table 8.

According to the survey data, teachers encourage their learners to use Write & Improve and believe it is valuable for use outside of the classroom. They also do not agree that teachers will be replaced by Write & Improve or that Write & Improve offers personalized feedback. They do, however, trust it to give accurate feedback, regardless of the ambiguities mentioned earlier. Teachers were often unsure about encouraging learners to use Write & Improve to notice errors, whether it is effective in supporting learners' writing at home, and whether it gives useful feedback to learners. However, this could be attributed to lack of knowledge of the technology rather than the effectiveness of the ICALL system itself. Teachers believe the ICALL system can be used to free up teacher time, and that automated feedback can

improve learners' writing. They also argue that the ICALL system is beneficial for supporting learners when working from home, echoing findings in Lu (2019). The teachers would also like learners to make greater use of Write & Improve.

Building on the survey data, the focus groups with teachers offered a more in-depth insight into their perspectives on Write & Improve. The teacher focus groups were conducted post study and were used to understand better the outcomes from the survey. The focus groups touched on a number of key themes, including the challenges of teaching writing, the nature of feedback traditionally given, and whether Write & Improve helped to address teachers' concerns and challenges.

The teachers identified that learners often have a fixed view of writing and have very little experience of extensive writing in either English or Turkish. Owing to this, teachers needed to address both the linguistic and discursive needs of learners. In terms of discourse, the teachers identified that they use a 'process approach', which focuses on drafting, editing and revising, and takes a genre pedagogy view of writing, understanding the generic make-up of texts. Their classes focus on the development of writing and critical thinking skills, and the teachers identify that the classes are mixed-ability, with some learners using quite complex sentence structures while others make basic errors with determiners and prepositions (as was seen in the error analysis section earlier). The teachers also recognise that their learners have limited vocabulary and overall, have no explicit language focus in their courses. This is problematic for them as they find that many of the problems that learners face in developing ideas in texts and creating coherent and cohesive writing is limited by their linguistic barriers i.e. learners cannot create coherent texts if they do not have the language to do so.

The learners' language problems impact on the feedback that teachers give (Stockwell & Reinders, 2019). Overall, the teachers teach approximately 12 hours per week. However, they also spend around 12 hours giving feedback, both written and oral. One teacher said that they had recently "spent a whole weekend, for example, giving feedback to learners." They find the learners want feedback on every error they make, and that owing to the mixed-ability of the class, each learner needs individual and tailored feedback. To address this, teachers have traditionally advocated for peer-feedback in order help students to notice mistakes, as they recognize that they cannot address all of the problems themselves. Moreover, as they are formatively marking written work, they find it challenging to give feedback without raising their learners' expectations in terms of grades and summative scores.

Many of these concerns and challenges were addressed by Write & Improve. Teachers said that the learners "love using Write & Improve and that some used it more than 50 times on one task to help eliminate errors." The teachers saw a value in the technology for giving feedback on grammar and for its ability to be tailored to learners' individual needs. The teachers reported that with the learners using Write & Improve, they spent less time on sentence-level feedback and were able to offer more personalized and complex feedback on discourse and coherence. This is an interesting finding to emerge from the study as the teachers reflect the combined use of automated and teacher feedback that Stevenson (2016) addresses. In so doing, they tackle the concerns raised by Lu (2019) as the teachers free themselves from sentence-level feedback to focus on more complex issues of coherence and discourse. Interestingly, this does not corroborate the claim within the literature that ICALL systems do not allow teachers to focus on more complex issues in feedback (Link, Mehrzad & Rahimi, 2020). Overall, while teachers did find Write & Improve to be effective, there were a number of concerns.

It seems the teachers' concerns largely center around issues of messaging and expectations. The teachers had experience of using technology for learner writing in the past which monitored for plagiarism and automatically corrected learners' language. There was a clear volition to have more explicit correc-

tions; however, it would seem that the value of Write & Improve was somewhat missed by the teachers where it is not concerned with correcting language but guiding learners to notice language errors and correct the errors themselves. There is, of course, much pedagogical value to this, following Schmidt's (1990) Noticing Hypothesis. Nonetheless, they each felt that the feedback was often too vague to be actionable and learners would bring queries to class that, at times, teachers could not address. They said that at times they could not see where the problems were. It transpired that they could not distinguish between an error and a suggestion to use more complex language, owing to Write & Improve's limited highlighting and coding of errors.

The teachers also felt that being able to add written and oral feedback to learners' work would be useful. They were also interested in Write & Improve affording greater focus on analysing coherence, cohesion, argumentation, and narratives. Additionally, they did not fully trust the ICALL system when it gave remarkably high scores to learners, as they did not believe their work reflected such CEFR levels. This seems to be a problem with messaging where, again, the CEFR level given for a task is not indicative of a learner's level, but of their performance on the task. In terms of functionality, the teachers found that the ICALL system worked well; however, they would prefer if they could see, from an overview, where they had already added feedback and where not, as they found themselves spending time finding where they had last entered feedback. They also felt it would be useful to retain multiple versions of a task from each learner to track changes over time. Finally, the teachers expressed interest in being able to use Write & Improve with plagiarism checkers, and in being able to use their own grading criteria and academic word lists to make it more relevant for writing in their own contexts.

CLOSING REMARKS: RESPONDING TO CALL THEORY APPLICATIONS FOR ONLINE TESOL EDUCATION

Reflecting on the core research questions that guide this research, each one is now addressed in turn.

In responding to Research Question 1, "How does Write & Improve impact the motivation of learners to write in English?", overall, the study demonstrates that learners find Write & Improve to be engaging and motivating, and is therefore worthy of pedagogical use. The Write & Improve ICALL statistics exemplify this motivation through the multiple attempts made by the learners in terms of error correction and redrafting tasks. The surveys and focus group results indicate that the learners were more motivated over time and the teachers believe that the learners enjoyed using the ICALL system and found it useful.

Reflecting on Research Question 2, "How does Write & Improve impact learners' writing behaviours?", learners appear to have positive attitudes towards writing. The ICALL statistics highlight that learners attempted tasks multiple times, either immediately or within a delayed timeframe, thus illustrating their efforts at editing, error correction, and redrafting processes. The teachers similarly opine that the ICALL system promotes drafting and other macro writing processes. However, there is lack of focus on discourse-level feedback, which is important for developing skilled writers.

Considering Research Question 3, "To what extent does Write & Improve advance learners' language?", there is evidence of linguistic improvement, with learners' CEFR writing levels increasing overall. The ICALL system is reported for being effective at error correction, and the teachers found that Write & Improve's feedback centered primarily on learner spelling and syntactic accuracy. There-

fore, there is both reported and empirical evidence to support the claim that Write & Improve can help learners improve their language.

Finally, reflecting on Research Question 4, “How does Write & Improve use by learners impact teachers’ practices?”, this study demonstrated that learner use of Write & Improve relinquishes teachers of the need to comment on sentence-level matters, and instead it affords them the opportunity to spend time dealing with more complex writing issues. As such, teachers find that generally Write & Improve saves them time. Overall, teachers had positive reactions to Write & Improve and found it valuable as a teaching and learning resource.

Issues also emerge in the use of Write & Improve for both teachers and learners, which signals important considerations for both the technology itself and wider research in CALL. Such concerns include the lack of clarity in feedback where feedback can be ambiguous and therefore inhibit learning. These ambiguities often frustrated learners and put pressure on teachers to resolve issues. Furthermore, teacher expectations are high and might be at odds with Write & Improve’s functionalities. As noted, this is more of a messaging and understanding issue than a problem with the technology itself. For future endeavours, training is therefore essential for both the technical use of the ICALL system and the pedagogical uses, as teachers need to understand Write & Improve more comprehensively in order to reap any benefits it affords. For example, rather than Write & Improve being used as a stand-alone resource, at the early stages of its adoption it could be used in a flipped classroom approach, where errors and non-complex structures are returned to during class time in order to foster further critical thinking on writing structures and processes. Teachers could thus scaffold the use of an automated error correction and feedback in the ICALL system. Over time, ICALL systems such as Write & Improve could then be used more autonomously by learners to improve their written language and writing skills. Moreover, future research in the area of learners’ errors and a longitudinal analysis of writing and redrafting would provide further insights into the pedagogical applications of this ICALL system.

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KEY TERMS AND DEFINITIONS

Automated Feedback: Automated feedback that is generated by software and delivered to directly to learners upon completing task.

CALL and Intelligent CALL Systems: CALL or Computer-Assisted Language Learning is a field of studies that in concerned with studying how technology can facilitate language learning. Specifically, Intelligent CALL Systems are language-teaching and -learning technologies that are informed by artificial intelligence.

CEFR: The CEFR is the Common European Framework of Reference for Languages. It is an internationally recognised approach to standardizing the linguistic knowledge and abilities that language users have at different levels of proficiency. These levels range from A1 (Beginner) to C2 (Master).

Corpus Linguistics and Corpora: Corpus linguistics is a field of study concerned with the analysis of large databases of language, known as corpora. One corpus or several corpora can contain written and/or spoken language texts and usually represent specific types of language e.g. learner language.

Error Correction: Error correction refers to the identification of errors in texts and the subsequent corrective feedback given to the learner.

Motivation: Motivation is concerned with understanding learners' affective engagement with a process or practice. Motivation can be intrinsic (based on personal feelings) or extrinsic (based on external expectations) and is typically used to understand learners' willingness or lack thereof to do something

Writing Skills: Writing skills is a polysemous concept. In this chapter, writing skills refer to the knowledge of writing practices that students need to communicate effectively through writing.

APPENDIX: ERROR TAGS

Figure 2. Error tag key

#AG	agreement error	#MJ	missing adjective
#AGA	anaphor agreement error	#MN	missing noun
#AGD	determiner agreement error	#MP	missing punctuation
#AGN	noun agreement error	#MQ	missing quantifier
#AGQ	quantifier agreement error	#MT	missing preposition
#AGV	verb agreement error	#MV	missing verb
#AS	argument structure error	#MY	missing adverb
#CD	wrong determiner because of noun countability	#R	replace error
#CE	complex error	#RA	replace anaphor
#CL	collocation or tautology error	#RC	replace link word
#CN	countability of noun error	#RD	replace determiner
#CQ	wrong quantifier because of noun countability	#RJ	replace adjective
#DA	derivation of anaphor error	#RN	replace noun
#DC	derivation of link word error	#RP	replace punctuation
#DD	derivation of determiner error	#RQ	replace quantifier
#DI	incorrect determiner inflection	#RT	replace preposition
#DJ	derivation of adjective error	#RV	replace verb
#DN	derivation of noun error	#RY	replace adverb
#DQ	derivation of quantifier error	#S	spelling error
#DT	derivation of preposition error	#SA	spelling American
#DV	derivation of verb error	#SX	spelling confusion
#DY	derivation of adverb error	#TV	incorrect tense of verb
#FA	wrong anaphor form	#U	unnecessary error
#FD	incorrect determiner form	#UA	unnecessary anaphor
#FJ	wrong adjective form	#UC	unnecessary link word
#FN	wrong noun form	#UD	unnecessary determiner
#FQ	wrong quantifier form	#UJ	unnecessary adjective
#FV	wrong verb form	#UN	unnecessary noun
#FY	wrong adverb form	#UP	unnecessary punctuation
#IA	incorrect anaphor inflection	#UQ	unnecessary quantifier
#ID	idiom wrong	#UT	unnecessary preposition
#IJ	incorrect adjective inflection	#UV	unnecessary verb
#IN	incorrect noun inflection	#UY	unnecessary adverb
#IQ	incorrect quantifier inflection	#W	word order error
#IV	incorrect verb inflection	#X	incorrect negative formation