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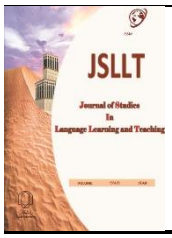

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An Attempt to Improve Grammatical Structure Retention: Impact of Computer-mediated Feedback on Iranian EFL Learners

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Abstract

Over the past years, the role of technology in education has been widely discussed. Despite it, ongoing debates persist regarding feedback in Computer-Assisted Language Learning (CALL). This study aims to fill gaps in the literature by assessing the effectiveness of focused computer feedback, including translingual feedback, correction requests, and repetitions, on short and long-term memory retention. It also seeks to determine the most effective approach for computer-mediated feedback in recalling language structures and gain insights into students' attitudes towards it. To achieve these goals, a total of 60 intermediate Iranian English as a Foreign Language (EFL) learners from Yazd University were randomly assigned to four groups, each corresponding to a different type of computer-mediated feedback. These groups, namely Meta-linguistic, Repetition, Clarification Request, and No Feedback groups, varied in specificity and format. After completing the computer-based assessment, the participants took two nearly identical multiple-choice tests three weeks apart to measure short and long-term retention, respectively. Furthermore, a questionnaire was meticulously designed and administered before and after the intervention to capture any shifts in participants' attitudes towards computer-mediated feedback. According to the findings, the metalinguistic and repetition groups had the highest retention gains in comparison to the other groups. Furthermore, the results strongly supported the superiority of the experimental groups over the control group in terms of retention. The outcomes from the questionnaire also evidenced a positive enhancement in the participants' attitudes towards computer-mediated feedback. Future research should explore the effectiveness of different combinations of computer-mediated feedback types. By studying the combined impact of two or more types of feedback on learners' memory, valuable insights could be gained, moving beyond isolated feedback approaches.

Keywords: Computer-mediated feedback, ICALL, Long-term retention, Short-term retention.

I | INTRODUCTION

The current literature on CALL abounds with examples of the outperformance of the learners using CALL in comparison with the traditional methods (Grgurović et al., 2013). Lin (2010) concluded that learners favor a computer-supported learning environment when they are learning L2. Technology provides the possibility to enrich L2 teaching and learning by keeping the quality of instruction with a minimum amount of teacher-student contact (Rassaei, 2019). As highlighted by Bush (2008),

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computers facilitate L2 learning because they can be used by the students when they need them and when the time is right. Godwin-Jones (2013) has also demonstrated that incorporating technology to learn a target language is very important in today's multicultural and multilingual global society.

Even though corrective feedback has been practiced for a long time in traditional classrooms, computer-based corrective feedback has gained interest only recently (Brudermann et al., 2021; Heift & Rimrott, 2008; Heift & Schulze, 2007, 2007; Heift, 2003, 2004; Nemat Tabrizi & Moghaddam Ranjbaran, 2021). Yeha and Lob (2009) put forward the view that the corrective feedback provided via written computer-mediated communication could contribute to the development of learners' metalinguistic awareness. This makes corrective feedback an efficient way to draw learners' attention to errors in written texts.

ICALL, as a recent subfield of CALL, utilizes Natural Language Processing techniques to help the presentation, reinforcement, and assessment of material to be learned. ICALL differs from CALL in that it offers often alternatively labeled 'intelligent' feedback features that customize responses to learner input. As Nagata (1993) highlighted, ICALL programs are effective tools in facilitating grammar instruction and learning when used with particular structures so that the range of errors can be anticipated and the appropriate feedback can be provided.

Garrett (as cited in Heift & Schulze, 2007) classified the computer-mediated feedback types into four branches including a) the mere presentation of the correct answer by the system, b) the indication of error location based on the computer's letter-by-letter comparison of the student's input with the machine-stored correct version, c) the presentation of error messages depending on the possible errors stored in the computer and the analysis of the anticipated wrong answers. and d) the employment of an NLP approach such as parsing through which the computer performs a linguistic analysis of the student's response.

As noted earlier, various attempts have been made to capture the effectiveness of various types of corrective feedback; however, there exists a considerable gap in the feedback literature in that little importance has been given to elucidate the impact of computer-mediated feedback on both learners' short and long-term retention. The evaluation of the relative effectiveness of the computer-mediated feedback types on short and long term retention in the area of CALL and ICALL is still in its infancy. Moreover, the low number of the investigations in this area (as explored by the researchers) reveals that little attention has been paid to the extent to which the students show positive or negative attitude towards the computer-mediated feedback.

Therefore, the present research has been built upon certain gaps in the literature. First, the study can explain the effectiveness of the three types of computer-mediated feedback, i.e. metalinguistic feedback, clarification request and repetition, on short and long-term retention in terms of the taxonomy of corrective feedback proposed by Lyster & Ranta (1997). Second, it is hoped that this study will eventually enrich our understanding of how computer-mediated feedback works and make us aware of its role in the retention of materials in the learners' minds. Third, although the research on feedback in ESL settings has flourished, investigating the attitude of the learners towards computer-mediated feedback merits more attention.

The study, thus, seeks to find the answers to the following research questions:

1) What type of corrective feedback delivered via computer is more effective for short-term retention?
2) What type of corrective feedback delivered via computer is more effective for long-term retention?
3) What is learners' attitude towards computer-mediated feedback?

II. REVIEW OF LITERATURE

The current study employs the Taxonomy of Corrective Feedback (TCF) introduced by Lyster & Ranta (1997) as the research framework. The study illustrated the types and distribution of CF moves and their correlation with learners' uptake. TCF is an amalgamation of six separate types of feedback, three of which have been employed as the basis of our investigation, i.e. repetition, meta-linguistic feedback and clarification request. They are further manipulated to suit the present study because they are realized differently from the oral classroom to an ICALL environment. The rationale behind using the TCF is that this typology has remained the most influential paradigm of corrective feedback so far and the categories provided in it can be altered and subsequently integrated into an ICALL environment. Moreover, as reviewed by the researchers, the investigations about the effect of ICALL on the retention of various aspects of language in short and long intervals are few; however, some of the more related studies are highlighted in this section.

Heift (2004) carried out a study on the relationship between feedback in CALL and learner uptake. Learner uptake is used in the same sense as the one used by Lyster & Ranta (1997), as learners' attempts to correct their mistakes after receiving feedback. The amount and specificity of the feedback provided and its presentation format were the distinguishing factors among feedback types. Heift's experimental study was grounded on three types of feedback including meta-linguistic, meta-linguistic + highlighting, and repetition + highlighting. Heift argued that among the three computer-mediated feedback groups, the metalinguistic plus highlighting group was the most effective at eliciting learners' uptake and that the repetition plus highlighting resulted in the least correct answers. The study seems to suggest compelling reasons in favor of the facilitative role of metalinguistic feedback on learners' self-correction within the CALL environment.

The medium through which the feedback is put across cannot be identical from an oral classroom to a CALL system. Given this assumptions, Heift illustrated the types of feedback found in classroom studies and their CALL counterparts (Table 1).

Table 1. Types of feedback in the oral classroom and the CALL environment.

Feedback type	Oral classroom	CALL
Explicit correction	You mean…	Correct answer
Recast	Teacher reformulation	Correct answer
Clarification request	What do you mean?	Try again!
Meta-linguistic feedback	Explanation of error type	Explanation of error type
Elicitation	Ellipsis	Highlighting
Repetition	Intonation	Highlighting

In a similar vein, the results obtained by Heift & Rimrott (2008) were consistent with their preceding findings. The study set out to investigate the learner responses to three distinct types of feedback for spelling mistakes made by English learners of German while using the E-Tutor, a parser-based online CALL program. To this end, the system identified a total of 1281 misspellings committed by the 28 participants as a result of their use of the E-Tutor over 15 weeks. To arrive at the objectives of the study, the E-Tutor displayed three distinct types of feedback for spelling errors: meta-linguistic with emphasis, meta-linguistic, and repetition. As in Heift (2004), the same combinatory style was used to select the types of feedback. The most correct responses were reported for the most explicit and prominent type, meta-linguistic with emphasis. For this reason, the results support the claim that meta-linguistic feedback is more effective in enabling the students to correct their misspellings and grammar mistakes. They also noticed that repetition led to the least amount of uptake in comparison with the other two groups.

In another study, Sherafati et al. (2020) assessed the effectiveness of employing computer-mediated teacher feedback and computer-generated feedback to enhance the writing skills of learners. Additionally, the researchers explored the motivational levels of the learners. For this purpose, a total of 60 intermediate EFL learners were carefully chosen from two intact classes and then randomly allocated to different

treatment groups. The outcomes derived from both paired samples t-test and independent samples t-test exhibited a noteworthy enhancement in the writing proficiency of the two groups, tracing from the pretest to the posttest phase. Specifically, based on a comparison of the posttest and delayed posttest results, only the group receiving the computer-mediated feedback had made a substantial advancement in writing skills. Furthermore, there was no considerable divergence of the posttest scores between the two groups, though a noteworthy variation emerged in their delayed posttest scores. The interview findings highlighted the learners' motivation for computer-mediated feedback, while opinions within the other group regarding motivation to embrace this approach differed. The research concluded by asserting that computers serve as an effective medium for offering feedback. Moreover, it was emphasized that learners do not perceive computers as the sole source of feedback, but rather as a supplementary tool alongside teacher feedback.

More recently, Brudermann et al. (2021) delved into the impact of a kind of computer-mediated corrective feedback (CF) on the advancement of written accuracy among learners in an online EFL course tailored for STEM (science, technology, engineering, and mathematics) students. This study extended the scope of a prior investigation, centering on the concept of unfocused indirect CF, which entailed providing metalinguistic commentary on various error categories without a specific targeting. The research entailed the implementation of this CF approach across multiple groups of STEM learners (N = 1,150) over a span of five years. The outcomes of the study demonstrated the effectiveness of combining computer-assisted unfocused indirect CF with supplementary computer-mediated micro-tasks in nurturing the development of writing accuracy.

The research conducted by Nemat Tabrizi & Moghaddam Ranjbaran (2021) aimed to explore the impact of computer-mediated corrective feedback using text-based and audio-based approaches on the enhancement of writing accuracy among Iranian EFL learners. The researchers selected a group of intermediate female Iranian students using cluster random sampling. The participants undertook a Nelson proficiency test to assess their initial proficiency level, followed by a pre-test to evaluate their writing accuracy baseline. The experimental groups were engaged in computer-mediated corrective feedback instruction, with one group receiving text-based correction and the other receiving audio-based correction. A control group followed their regular teaching method. A post-test was administered to measure changes in writing accuracy after the intervention. The results revealed that both computer-mediated audio-based and text-based corrective feedback led to improved writing accuracy among Iranian EFL learners. Additionally, the group receiving audio-based corrective feedback demonstrated greater improvement compared to the text-based feedback group.

Despite the striking findings, the scope of comparison studies examining certain types of corrective feedback, especially in the domain of CALL, is still too narrow to argue for the effectiveness of one type over another. Moreover, the reviews revealed that the number of the studies on the effect of ICALL on the retention of various aspects of language in short and long intervals is rare. Therefore, there is a need to carry out some research on the effect of ICALL on different levels of retaining various aspects of learning a language.

III. METHOD

1. Participants

To accomplish the main objectives of the study, 60 Iranian EFL learners majoring in English literature at the BA level at Yazd University were employed to take part in the present research. They consisted of 32 female and 28 male students aged from 18 to 30. In order to ensure the least difference among the participants, two criteria were considered for the selection of the participants: (a) a standardized Quick Oxford Placement Test (QOPT) that was administered prior to the experimental phase of the

study to ensure their proficiency level (b) and a designed multiple-choice test of grammar which was administered to ensure the uniformity of the participants with regard to the knowledge of reported speech. Then, based on the results obtained from the above-mentioned criteria, 60 intermediate students were selected for the purpose of the study. The participants were randomly divided into four groups including three experimental groups and one control group. The experimental groups were labeled as (a) repetition group, (b) clarification request group, and (c) meta-linguistic group. The participants in the experimental groups were informed of their errors through exposure to computer-mediated repetition, clarification request, and meta-linguistic feedback by the designed software, respectively; however, those in the control group did not receive any feedback (no feedback group).

2. Instrumentation

The instruments that were used to obtain the data required for the present study are comprised of the Oxford Quick Placement Test (OQPT), the multiple-choice test of grammar to ensure the participants' background knowledge of reported speech (pretest), the computer program providing computer-mediated feedback, two almost similar multiple-choice tests designed specifically to examine the effect of short and long-term retention (immediate and delayed posttests), and a questionnaire administered solely to check the contribution of learners' attitudes to their performance.

2.1. Pretest

In addition to the OQPT, which focuses on the language proficiency level of the learners, a designed 30-item multiple-choice test of grammar was administered to ensure the uniformity of the participants with regard to the knowledge of reported speech. Each question in the pretest was designed to appear as a typical grammar assessment, covering a range of grammatical concepts beyond reported speech, such as verb tenses, sentence structures, subject-verb agreement, and punctuation. By incorporating diverse grammatical topics, the test aimed to prevent the participants from anticipating the specific area of grammar being evaluated. Moreover, the items varied in difficulty to ensure that the participants were challenged appropriately. The results of the MC test indicated no significant difference among the groups in this regard before the conduction of the computer-based test.

2.2. Computer Program

During the second semester at Yazd University, a computer program was used to help with the study. This program gave smart feedback on mistakes made by learners. In this computer-based test, the students had to change thirty direct sentences into indirect speech. The test took about 90 minutes in total, with an average of three minutes per question. The computer screen had different parts: an input field where the students typed their answers, a feedback field that showed if the answer was correct or not, a timer showing the total time, and the time left for each question. There were also three buttons. The first button, labeled "Check", checked if the answer was right and let the student know if there were any mistakes. The "Hint" button gave hints related to the type of the mistake made. The "Next" button allowed the students to move on to the next question.

2.2.1. The Three Types of Feedback

As mentioned earlier, one of the most prevailing applications of parser-based CALL is to provide intelligent, informative, and error-specific instructional feedback. The provided feedback differs from the indication of error to the specification of the error location up to the provision of additional information concerning the nature of the error. Figures 1-2 illustrate the distinctions between the three types of feedback that are of interest to the current study:

For the meta-linguistic (ML) feedback, the participants received comments or questions regarding the well-formedness of the utterance. The ML feedback informed the test takers of the existence of an error, the

location of the error in the sentence, and the comments depending on the nature of the error, as demonstrated in Example (1).

Example 1. A learner has typed: Sarah: Sarah said that the car was stolen.

Computer-mediated feedback: You made a mistake with the verb "was stolen". In reported speech, the tense of the verb must change accordingly.

Conversely, repetition is represented through text enhancement strategies that manipulate the typography (e.g. larger font size, different typefaces) or use typographic cues (e.g. italic, boldface, capitalization, underlining, and color coding) to highlight the error. As described by Doughty & Williams (1998), it is an implicit and unobtrusive means to draw the learners' attention to the forms contained in the written input. In contrast to the ML feedback, repetition informed the test takers about both the existence of an error and its location without providing some further explanations on the nature of the error. As given in the example below, the error is highlighted through boldface formatting.

2. A learner has typed: Sarah: Sarah said that the car was stolen.

Computer-mediated feedback: ***was stolen***

For the third type of feedback, i.e. clarification request, the program does not provide comments or questions, nor does it highlight the error (see Example 3). Instead, a clarification request is represented simply by using phrases like "Try again" or "Sorry" in order to indicate the error.

3. A learner has typed: Sarah: Sarah said that the car was stolen.

Computer-mediated feedback: Try again!

2.3. Posttest and Delayed Posttest (Multiple-choice Tests of Retention)

The computer-based exam was then followed by two 20–item MC tests to evaluate the relative effects of the computer-mediated types of feedback on the learners' retention. One of the MC tests was distributed to the participants immediately after the computer-based test to measure the impact of the computerized feedback on their subsequent performance. The delayed posttest, which was almost similar to the previous test in terms of length, format, and content, was administered at a three-week interval to measure the long-term effect of the computer-mediated feedback types.

The internal consistency estimates of reliability were calculated for the computer-based test as well as each multiple choice test. Cronbach's alpha was .81 for the pretest, .70 for the computer-based test, .72 for the immediate posttest, and .86 for the delayed posttest. As it can be seen, the values associated with all the tests are well above .7, suggesting their highly acceptable internal consistency reliability.

2.4. Questionnaire

In the study, the questionnaire was carefully designed and administered twice, first as the Pre-treatment Questionnaire (PreQ) and then as the Post-treatment Questionnaire (PostQ). The purpose of administering the questionnaire twice was to assess the extent to which the students showed positive or negative attitudes towards computer-based testing and computer-mediated feedback, regardless of their assigned feedback group. Additionally, both PreQ and PostQ demonstrated good internal consistency, with reported Cronbach's alpha coefficients of .82 and .76, respectively. The respondents were asked to indicate their level of agreement or disagreement with the items using a 5-point Likert scale. This approach allowed for a comprehensive evaluation of the participants' attitudes toward computer-mediated feedback.

However, the need to justify the questionnaire's administration process arises from participants' potential unfamiliarity with computer-mediated feedback during the initial administration. This aspect was carefully considered to ensure the validity and reliability of the questionnaire in capturing the participants' attitudes accurately.

3. Analyses

This study employed two mixed between-within subjects analysis of variance followed by post hoc pairwise contrasts to evaluate the effects of different types of feedback on short and long-term retention with one between-subjects factor, namely feedback type (control, metalinguistic, repetition, and clarification request) and one within-subjects factor, namely time (pretest, CBT, immediate posttest, delayed posttest). Moreover, a paired-samples t-test was run to seek the overall attitudes of the participants towards computer-mediated feedback.

IV. RESULTS

The process of analyzing the data involved a wide range of quantitative methods of analysis. The data obtained from the instruments were fed into the SPSS software version 16 for detailed statistical analyses.

A one-way between-groups ANOVA run on the pre-test scores found no statistically significant difference among the four groups, $F(3, 56) = .26$, $p = .84$, indicating the homogeneity of the groups in the knowledge of reported speech prior to the conduction of the main study.

1. Short-term Retention

A mixed ANOVA with post-hoc comparisons was conducted to assess the impacts of four types of feedback on the participants' short-term retention across two time periods (computer-based test and immediate post-test). Table 2 presents the descriptive statistics for all the feedback groups. From CBT to immediate posttest, all the experimental groups had a mean gain with the metalinguistic and repetition groups with the highest mean gains, indicating the prominent role played by computer-mediated feedback. In contrast, the clarification request and control groups had a less satisfactory performance. Therefore, it can be concluded that all the provided corrective feedback types in the ICALL platform had effects on the short-term retention of the test-takers. The control group, however, had the least satisfactory performance, which is attributed to the lack of exposure to computer-mediated feedback.

Table 2. Descriptive statistics for the four groups: Results from the CBT and the immediate posttest.

	Corrective_feedback	Mean	Std. deviation	N
CBT_new	Metalinguistic	78.10	10.778	15
	Repetition	78.54	14.769	15
	Clarification request	59.84	20.978	15
	No feedback	59.84	22.619	15
	Total	69.08	19.799	60
Immediate_posttest_new	Metalinguistic	97.67	3.716	15
	Repetition	94.67	5.164	15
	Clarification request	81.33	16.740	15
	No feedback	62.67	19.445	15
	Total	84.08	18.967	60

The results revealed no significant interaction between feedback types and time, Wilks' Lambda = .91, F (3, 56) = 1.76, p = .16, partial eta squared = .04. However, there was a substantial main effect for time, Wilks' Lambda = .71, F (1, 56) = 22.37, $p < .000$, partial eta squared =.28, with all groups showing improvement across the two time periods. The pair-wise comparisons table with significance level .000 revealed a significant difference between the CBT and immediate post-test. The significance value between CBT and the immediate posttest is indicative of the effectiveness of computer-mediated feedback on learners' short-term retention.

The result of the between-subject effect was significant, F = 25.66, $p = .000$, partial eta squared = .579, indicating a marked difference in the effectiveness of four feedback types. Using the commonly used guidelines proposed by Cohen (1988, pp. 79-81): .01=small effect, .06=moderate effect, .14=large effect, the result suggests a large effect size.

To determine inter-group variation, a multiple comparison table revealed lack of significant difference between metalinguistic and clarification request groups (p=.988), and between clarification request and no feedback groups (p=.094).

Table 3. Multiple comparisons: Results from the CBT and the immediate posttest.

					95% Confidence interval	
(I) Corrective_feedback	(J) Corrective_feedback	Mean difference (I-J)	Std. error	Sig.	Lower bound	Upper bound
Repetition	Metalinguistic	-1.28	3.600	.988	-11.66	9.10
	Clarification request	16.02*	3.600	.001	5.64	26.39
	No feedback	25.35*	3.600	.000	14.97	35.73
Clarification request	Metalinguistic	-17.30*	3.600	.000	-27.67	-6.92
	No feedback	9.33	3.600	.094	-1.04	19.71
No feedback	Metalinguistic	-26.63*	3.600	.000	-37.01	-16.25

2. Long-term Retention

Another mixed ANOVA was conducted to explore the impact of four different feedback types on participants' scores across two time periods (CBT and delayed posttest). Table 4 illustrates the mean and standard deviation for all four feedback groups in the CBT and delayed posttest. As illustrated in Table 4.3, the metalinguistic and repetition groups are more effective for sustained gains compared to the clarification request and control groups. Conversely, the provision of computer-mediated clarification request feedback could contribute less to the development of learners' grammatical awareness.

Table 4. Descriptive statistics for the four groups: Results from the CBT and the delayed posttest.

	Corrective_feedback	Mean	Std. deviation	N
CBT_new	Metalinguistic	78.10	10.778	15
	Repetition	78.54	14.769	15
	Clarification request	59.84	20.978	15
	No feedback	59.84	22.619	15
	Total	69.08	19.799	60
Delayed_posttest_new	Metalinguistic	92.67	5.936	15
	Repetition	92.00	8.409	15
	Clarification request	74.00	10.212	15
	No feedback	70.67	18.310	15
	Total	82.33	15.251	60

There was a substantial main effect for time, Wilks' Lambda = .68, F (1, 56) = 26.59, $p < .05$, partial eta squared = .31, corroborating a marked change in the scores across the two different periods. Consequently, it substantiates the impact of the above-mentioned feedback types on learners' long-term retention. However, there was no significant interaction between feedback type and time, Wilks' Lambda = .99, F (3, 56) = .104, $p = .95$, partial eta squared = .006.

The results indicated that although the metalinguistic and repetition feedback groups achieved more correct responses, the difference between them was insignificant (p=1). Likewise, the difference between the clarification and no feedback groups was not also significant (p=.983).

Table 5. Multiple comparisons: Results from the CBT and the delayed posttest.

(I) Corrective_feedback	(J) Corrective_feedback	Mean difference (I-J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Repetition	Metalinguistic	-.11	4.115	1.000	-11.97	11.75
	Clarification request	18.35*	4.115	.001	6.49	30.21
	No feedback	20.02*	4.115	.000	8.16	31.88
Clarification request	Metalinguistic	-18.46*	4.115	.001	-30.32	-6.60
	No feedback	1.67	4.115	.983	-10.19	13.53
No feedback	Metalinguistic	-20.13*	4.115	.000	-31.99	-8.27

In order to have the visual inspection of the data, the following bar graph is generated by SPSS. The graph gives us the chance to observe the mean scores of all four groups across time.

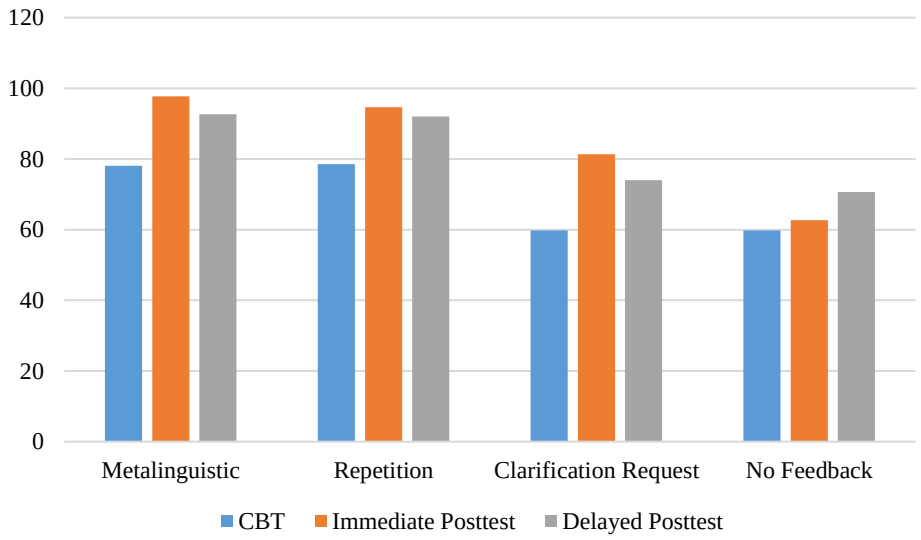

Figure 1. Bar graph representing the overall comparisons among the participants in the three time periods.

3. Questionnaire

It was also mentioned in the previous chapter that the questionnaire was handed to the participants twice for the sake of providing us with the opportunity to compare the participants' viewpoints before and after the conduction of the computer-based test and the presentation of the computer-mediated feedback. The overall attitude of the participants was investigated through running a paired-samples t-test without taking into account the feedback types.

The results obtained from the paired-samples t-test showed that there was a statistically significant increase in the test takers' positive attitude from Time 1 (M = 56.48, SD = 4.84) to Time 2 (M = 70.57, SD = 8.17),

t(59) = 11.96, p = .000 (two-tailed). The mean increase in attitude score was 14.09 with a 95% confidence interval ranging from -16.44 to -11.73. The eta square was calculated using the proposed formula (.70), indicating a large effect size. It can be concluded from the findings that the participants adopted a more positive attitude towards the feedback delivered through computer after treatment. Table 4.5 displays the results of the paired-samples t-test with regard to the test takers' attitudes.

Table 6. Paired samples test results for attitudes.

		Paired differences					t	df	Sig. (2-tailed)
					95% confidence interval of the difference				
		Mean	Std. deviation	Std. error Mean	Lower	Upper			
Pair 1	attitude_pre - attitude_post	-1.4088	9.12394	1.17790	-16.44585	-11.73193	-11.961	59	.000

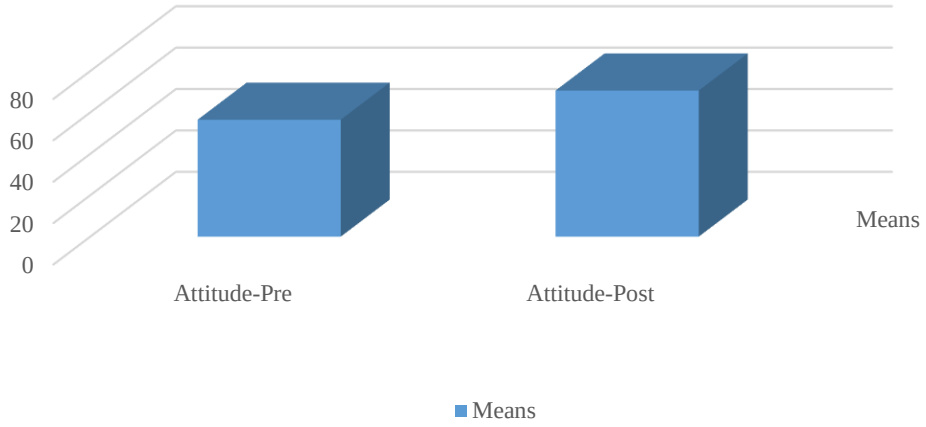

Figure 2. Bar graph for attitude: Results from the questionnaire.

V. DISCUSSION AND CONCLUSION

This study aimed to fill a gap in the existing literature by assessing how computer-mediated corrective feedback affects the short and long-term retention of reported speech. To this end, the study benefited from the Taxonomy of Corrective Feedback introduced by Lyster & Ranta (1997) within an ICALL platform. More specifically, learners' attitude towards the feedback delivered via computer was investigated in this research. In what follows, first, a discussion of various feedback types as well as the applied questionnaire will be provided. Afterwards, the research questions raised at the beginning of the article will be addressed. Finally, the implications of the study and the suggestions for further research will be taken into account.

The findings of the current study revealed overwhelming evidence in support of applying metalinguistic feedback in an ICALL platform. It was found that an explicit type of corrective feedback providing comments, information, or questions could raise the learners' awareness of the well-formedness of reported speech sentences. This is consistent with the conclusions derived from earlier studies on the nature of corrective feedback in CALL (Heift & Rimrott, 2008; Heift, 2004; Nagata & Swisher, 1995; Sauro, 2009). However, the results provide contradictory evidence against the studies carried out by Kregar (2011), Loewen & Erlam (2006), and Sanz (2004).

Regarding the repetition group, the following conclusions were drawn. First, the computerized repetition alongside the metalinguistic feedback proved to be an effective tool to be used in computer programs and online computer-based tests due to its ability to assist learners in correcting their errors. Second, the difference between the computerized metalinguistic and repetition feedback was found to be insignificant, indicative of their equal effects on the participants' retention. Finally, the repetition feedback turned out to be of a greater effect on the participants' short-term than long-term retention.

The results of this study align with Heift's (2004, 2008) research, which explored feedback efficacy in CALL environments. Similar to Heift's findings, it was observed that metalinguistic feedback promoted the learner uptake and self-correction. This correspondence underscores the value of explicit feedback in enhancing language learning outcomes. Moreover, the present study and Heift's work both suggest the positive influence of repetition feedback, reinforcing the importance of multiple feedback mechanisms in ICALL settings.

While not directly analogous, the research outcomes echo the results of Sherafati et al. (2020), who investigated the impact of computer-mediated feedback on writing skills. The results showcase the positive effects of computer-mediated feedback on retention, resonating Sherafati's findings of improved writing proficiency through technology-mediated interventions.

Though differing in context, the present study concurs with the research by Brudermann et al. (2021), which emphasized the role of computer-mediated feedback in enhancing accuracy. The findings underscore the potential of computer-mediated feedback to improve learners' grasp of subject matter, aligning with Brudermann et al.'s emphasis on written accuracy advancement.

The results of the current study mirror the exploration by Nemat Tabrizi & Moghaddam Ranjbaran's (2021) as how computer-mediated corrective feedback affects writing accuracy. This parallel underscores the effectiveness of various computer-mediated feedback types in fostering retention and learning improvement.

The range of studies cited in the present research collectively strengthens the evidence for the positive impact of explicit feedback on language learning. The diversity in the contexts and feedback types examined in these studies resonates the present comprehensive approach to assessing the different effects of feedback mechanisms on both short-term and long-term retention. To the best of the researcher's knowledge, the present study is among the attempts that shed light on the nature of clarification request in the domain of CALL. Besides, the current literature on clarification requests in the classroom context abounds in examples where studies are based solely upon a comparison of pretest and immediate posttest (Kwon & Lee, 2011; Loewen & Nabei, 2007; Lyster & Ranta, 1997). Consequently, the current research contributes to the understanding of long term effect of computer-mediated clarification request. The inclusion of a delayed posttest design that evaluates learning gains over time is essential in order to take the lasting effects of the feedback type into account.

The results from the questionnaire also indicated a fourteen-percent increase in the attitudes of the test-takers, which is regarded as a significant value with a great effect. Therefore, the findings seem to provide convincing evidence to argue that the computer-mediated feedback should be incorporated more into educational and academic curricula. Likewise, the first section of the questionnaire provided evidence to believe that CBT offers real advantages over the traditional paper-based methods of testing and that the examinees experience less fatigue with CBT compared to the traditional paper-based methods of testing.

Having discussed the major findings in the light of the previously-conducted studies, the rest of this section strives to find fully-fledged responses to the research questions proposed at the beginning of the study. The first research question sought to find out which of the three types of feedback would play a more significant role in learners' short-term retention. There was a significant difference in the participants' performance between CBT and the immediate post-test. This study clearly demonstrated that the

metalinguistic and repetition groups left a greater influence than the other two groups. There was also no significant difference between the metalinguistic and repetition groups, on the one hand, and the clarification request and no feedback groups, on the other hand.

The second question under discussion was the effect of the computer-mediated corrective feedback on the learners' long-term retention. In order to explore the impact of the computerized feedback types on the learners' long-term retention, the results from the CBT and the delayed post-test had to be taken into consideration. It can be generally inferred that computer-mediated metalinguistic and repetition feedback is more thriving than clarification request.

The third research question investigated learners' attitude towards CBT and, more specifically, computer-mediated feedback. To find the response to this question, the results from the questionnaire were analyzed. The findings of this study were quite convincing, and two conclusions were drawn. First, the participants developed more positive attitude towards CBT in general and the computer-mediated feedback in particular. Second, the results offered real advantages for CBT over the traditional paper-based methods of testing.

Acknowledging that the general implications of a single study have to be drawn cautiously, there exist certain pedagogical implications for EFL instructors, teacher trainers, syllabus designers and materials developers. To keep up with the new trend, nowadays instructors need to incorporate technology more into their lesson plans and find a substitution for the traditional grammar instruction by engaging learners in computer-based activities in order to increase the learners' motivation and raise their consciousness. The results of this study can also be illuminating for teacher training courses. Likewise, the teacher trainers can exploit the inherent potential of the world of technology to enhance the effectiveness of their instruction. CALL applications and facilities can assist teacher trainers by creating a linkage between off-the-job and on-the-job learnings during their training sessions. In addition, syllabus designers, material developers and course designers could greatly benefit from the results of this study. Syllabus designers can incorporate computer-based materials throughout their lessons to add variety, diversity and flexibility to their syllabus. In the same vein, most of the textbooks and coursebooks nowadays are accompanied by an interactive CD or DVD.

The current study also provides some suggestions that may extend the domain of research and contribute to the new findings. First of all, the approach taken in the present study in both methodology and design is purely quantitative. Therefore, it is recommended to replicate the study with a mixed quantitative-qualitative approach. Additionally, future research should concentrate on the effects of various possible combinations of computer-mediated types of feedback on the retention of the participants. Moreover, the present study was exclusively carried out on the retention of the grammar rules of reported speech. Further extensive and in-depth investigations of the impact of computer-mediated feedback on EFL learners' retention of other grammatical areas is called for to increase the validity of the results and the transferability of this study to other similar settings.

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APENDICES

Pretest

1. The children were tired because they …….. in the pool all afternoon.

a. had been swimming
b. have been swimming
c. had swum
d. would have swum

2. She said, 'These mangoes are rotten.'
She said that …….. mangoes…….

a. those, are rotten
b. these, are rotten
c. those, were rotten
d. these, were rotten

3. The last bus always seems to leave early. I wish the driver ……..until the right time before leaving.

a. waits
b. waited
c. had waited
d. would wait

4. He told her, "I want to leave for Delhi tonight."
He told her that he ……. to leave for Delhi…….

a. wanted, that night
b. want, that night
c. wanted, tonight
d. want, tonight

5. He asked me, "Have you finished reading the newspaper?"
He asked me …… reading the newspaper.

a. If I have finished
b. If I finished
c. whether I have finished
d. whether I had finished

Immediate Posttest

1. "She likes working in Paris"
She said _____ in Paris.

a. she had liked working
b. she liked working
c. she likes working
d. she has liked working

2. "Was the film produced by Spielberg in 1991?"
One of the students asked _____ by Spielberg in 1991.

a. whether the novel had been produced
b. whether the novel was produced
c. if the novel has been produced
d. if the novel was produced

3. "She bought the dress last night."
He told me _____

a. she had bought the dress last night.
b. she has bought the dress last night.
c. she had bought the dress the night before
d. she has bought the dress the night before

4. "We are playing tennis next Tuesday."
They said that _____

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a. they were playing tennis the following Tuesday
b. they have been playing tennis the following Tuesday
c. they were playing tennis next Tuesday
d. they have been playing tennis next Tuesday

5. "Where can I park my car?"
She asked the policeman _____ her car.

a. where she can park
b. where she could park
c. where can she park
d. where could she park

Delayed Posttest

1. "Light travels in a straight line."
The teacher explained that _____ in a straight line.

a. light had traveled
b. light traveled
c. light travels
d. light has traveled

2. "Was the novel written by Dickens in 1838?"
One of the students asked _____ by Dickens in 1838.

a. whether the novel had been written
b. whether the novel was written
c. if the novel has been written
d. if the novel was written

3. "Pam visited us last night."
Pete said _____

a. Pam had visited him last night.
b. Pam has visited him last night.
c. Pam had visited him the night before.
d. Pam has visited him the night before.

4. "We are getting married next Friday."
She assured us _____

a. they were getting married the following Friday.
b. they have been getting married the following Friday.
c. they were getting married next Friday.
d. they have been getting married next Friday.

5. "Where can I buy a magazine?"
The tourist asked the man _____ a magazine.

a. where he can buy
b. where he could buy
c. where can he buy
d. where could he buy

Questionnaire

Student Name: **Gender:** Male □ Female □

The amount of exposure to using computer:

□ 2 years or less □ 3-4 years □ 5-6 years □ 7-8 years □ 9-10 years □ more than 11 years

How often do you use a computer?

□ Every day □ Several times a week □ Once a week □ Once a month or less □ Never

How would you rate your ability to use a computer?

□ Excellent □ Good □ Fair □ Poor

Educators have employed a large number of technological tools to enhance student learning. One of these innovations is Computer-based Testing (CBT), a form of assessment in which students respond to items in a computer environment instead of taking a traditional paper-and-pencil test. It is worth mentioning that "computerized feedback" is used here to refer to the feedback provided by the computer on the learners' errors. The purpose of this questionnaire is to gain a better understanding of the students' perceived attitude towards CBT and the computerized feedback.

Please read each of the following sentences and then choose one of the alternatives based on your attitude towards each statement.

1 (Strongly Disagree), 2 (Disagree), 3 (Neutral), 4 (Agree) and 5 (Strongly Agree)

No.	Questions	1	2	3	4	5
1	Computer-based Testing (CBT) offers real advantages over traditional paper based methods of testing.					
2	Because CBT presents the questions one by one at a time, it can make the test easier to take.					
3	Examinees experience less fatigue with CBT comparing to traditional paper based methods of testing`.					
4	Recording answers is easier in CBT.					
5	CBT constitutes a more relaxed and stress-free atmosphere.					
6	I generally have positive attitude towards using computers in language testing.					
7	CBT can never be as good as paper-and-pencil tests.					
8	Reading from computer screen is more difficult than reading from pages.					
9	In CBT I can understand the reasons for mistakes better than I do in traditional methods.					
10	Computerized feedback gives me enough information on where I went wrong.					
11	I found the feedback provided by computer quite useful.					
12	I prefer computerized feedback to the traditional classroom forms.					
13	Computerized feedback helps me revise my problems more effectively.					
14	Computerized feedback helps me perform better in the next tests.					
15	Feedback provided by computer is clear and comprehensible.					