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Corrective feedback and learner uptake in CALL

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Abstract

This paper describes a study in which we investigated the effects of corrective feedback on learner uptake in CALL. Learner uptake is here defined as learner responses to corrective feedback in which, in case of an error, students attempt to correct their mistake(s). 177 students from three Canadian universities participated in the study during the Spring semester 2003. The study considered three feedback types: Meta-linguistic, Meta-linguistic + Highlighting, and Repetition + Highlighting. Study results indicate that feedback that provides an explanation of the error and also highlights the error in the student input (Meta-linguistic + Highlighting) is most effective at eliciting learner uptake. The study also considered two learner variables, gender and language proficiency. Our data suggest that none of the two learner characteristics has a significant impact on student responses to corrective feedback.

1 Introduction

Issues regarding the role and contribution of corrective feedback for language learning have been central to second language acquisition (SLA) theory and pedagogy. Corrective feedback has received much attention in the oral classroom lately, in particular, studies that investigate the effectiveness of *recasts*. Following Lyster & Ranta (1997), recasts involve a teacher's reformulation of a student's utterance, minus the error, sometimes also referred to as "paraphrase" (see Spada & Fröhlich, 1995).

Nicholas *et al*. (2001), for example, found that recasts appear to be most effective in contexts where it is clear to the learner that the recast is a reaction to the accuracy of the form, not the content, of the original utterance (see also Ellis *et al*., 2001; Lyster, 2001; Long *et al*., 1998; Mackey & Philp, 1998). More general, studies further indicate that the efficacy of corrective feedback in the oral classroom is determined by a number of factors. For instance, Havranek & Cesnik (2001) found that the success of corrective feedback is affected by its format, the type of error, and certain learner characteristics. Of the learner characteristics taken into consideration, verbal intelligence, relative proficiency (within levels at school or university), and the learner's attitude towards correction proved to be most influential. Despite a vast interest in studying the role of corrective feedback in the oral classroom, very little research has been conducted for the

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Computer-Assisted Language Learning (CALL) environment (see Bangs, 2002; Felix, 2002). Due to a difference in modes of instruction, however, the studies and their outcomes will most likely vary for the two respective learning environments and thus independent research in both areas is needed.

The limited research that does exist for grammar instruction in CALL can be classified into two categories: performance-based and interaction-based studies. The goal of the former is to examine the effects of different types of feedback on the learning outcome. For example, Nagata (1993, 1996, 1997) found that meta-linguistic feedback – feedback that explains the type of an error – is more effective than traditional feedback. A study group that received meta-linguistic feedback performed significantly better on a post-test than a control group which received no error explanation (see also van der Linden, 1993; Yang & Akahori, 1999). In contrast, performance-based studies (Heift, 2001, 2002, 2003; see also Pujolà, 2001; Bationo, 1992) are primarily concerned with the ways in which students use CALL applications. Tracking technology, in particular if implemented in Web-based applications, allows researchers to collect large data sets for subsequent analyses. User responses and navigation patterns can be recorded in a data log. The findings can make suggestions for software design and thus optimal software usage, all of which will eventually contribute to a more effective language learning environment.

The present study investigates learner feedback in CALL with respect to learner uptake, defined here as student responses to corrective feedback in which, in case of an error, learners attempt to correct their mistake(s). Our study considered three types of feedback: *Meta-linguistic, Meta-linguistic + Highlighting*, and *Repetition + Highlighting*. The feedback types differ in the amount and specificity of information provided to the learner, and the presentation format. The three feedback types were chosen because they all allow for a *negotiation of form*, that is, an interactive environment in which students receive corrective feedback that encourages them to attend to linguistic form and to revise their input. A study by Robinson *et al.* (1985), for instance, showed that greater learning gains were achieved with feedback that identified an error but still required the learner to locate the error and correct it. It is the goal of the present study to investigate whether students are more inclined to revise their input and show more learner uptake for certain types of feedback than for others.

In the following, we first discuss the theoretical issues surrounding our study and then explain our three feedback types. In Sections 3 and 4, we describe our study participants and study procedures. In Section 5, we present our results and address further research questions. Concluding remarks follow in section 6.

2 Background

The theoretical background of the current study is supported by the interactionist SLA theory (Gass, 1997; Long, 1996; Pica, 1994) and the Noticing Hypothesis (Schmidt, 1990) The Interaction Hypothesis suggests that negotiated interaction can facilitate SLA and that one reason for this could be that, during interaction, learners may receive feedback on their utterances. According to Schmidt (1995:20), the Noticing Hypothesis states that "what learners notice in input becomes intake for learning". However, the following conditions apply (for a more detailed discussion, see also Cross, 2002; Hegelheimer & Chapelle, 2000):

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1. Linguistic input needs to be both syntactically and semantically comprehended in order to be acquired by the learner (commonly referred to as intake).
2. Input is more likely to become intake if it is noticed.
3. Learners are most likely to notice linguistic form during interaction (negotiation of form).
4. Most useful are interactions that help learners comprehend the input and that help learners improve the comprehensibility of their linguistic output.

Given these assumptions, the quality of interaction between the computer and the learner is also determined by the type of feedback the system provides. Considering SLA theory, there are a number of studies that investigated corrective feedback and learner uptake in the oral classroom. For example, Lyster & Ranta (1997) in their study of immersion classes at the primary level found the following types of feedback used by language instructors:

1. Explicit correction
2. Recast
3. Clarification
4. Meta-linguistic feedback
5. Elicitation
6. Repetition

The study further showed that feedback types (1)–(3) were most commonly used, (4) and (5) were most effective at eliciting uptake, and (6) often co-occurred with feedback types (1)– (6). Due to the medium, feedback in a CALL environment cannot be identical to feedback in the oral classroom, however, Table 1 illustrates the types of feedback found in classroom studies and their proposed CALL counterparts:

Explicit Correction and *Recast* are very similar with respect to learner uptake. Both feedback types provide the correct answer. Unlike *Recasts*, however, *Explicit Correction* provides the correct form overtly to the learner (You mean…). However, neither *Explicit Correction* nor *Recasts* can lead to learner uptake in a CALL environment. Once the correct answer has been supplied by the system, learner uptake and thus a negotiation of form between the learner and the CALL program is not an option (see Lyster, 2001).

Clarification with its "Try again!" counterpart in CALL provides no guidance to learners to correct their mistakes. In the absence of a language instructor, however, it is desirable to achieve a more enhanced interaction between the CALL program and the

Table 1. *Feedback types in the oral classroom and CALL environment*

Feedback Type	Oral Classroom	CALL
Explicit Correction	You mean …	Correct answer
Recast	Teacher Reformulation	Correct answer
Clarification	What do you mean?	Try again!
Meta-linguistic Feedback	Explanation of error type	Explanation of error type
Elicitation	Ellipsis	Highlighting
Repetition	Intonation	Highlighting

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learner, one in which learners receive more detailed feedback on their work and progress. Nevertheless, there are successful implementations of this feedback type when augmented with guidance to additional learner resources. Levy (1999), for example, in his CALL program for advanced ESL learners discusses the positive effects of learner guidance through the implementation of lights. For the purpose of our study, however, this feedback type was not included. We anticipated that the strong contrast between *Clarification* and the remaining three feedback types might in itself have an effect on student responses to corrective feedback.[1]

The feedback types of interest to the current study are *Meta-linguistic* feedback, *Elicitation* and *Repetition*. *Meta-linguistic* feedback is the most elaborate form in that learner mistakes are precisely identified and students are given an explanation of the error without, however, the system giving away the correct answer. In this respect, the interaction between the CALL program and the learner is enhanced in that learners are guided in their mistakes towards a possible correct answer.

Elicitation and *Repetition* are very similar in a CALL environment in that both prompt the learners to correct their mistakes without, however, giving an explanation of the error. In the oral classroom, *Elicitation* and *Repetition* are manifested by pauses and intonation, respectively. While this is not possible in a CALL environment, highlighting has been chosen as a close approximation.[2]

Accordingly, the goal of the present study is to examine the effects of corrective feedback on learner uptake. In particular, the following research questions are addressed:

1. What is the distribution of corrective feedback types in relation to learner uptake? Of interest to the current study are the following feedback types: Meta-linguistic, Meta-linguistic + Highlighting, and Repetition/Elicitation + Highlighting?
2. What is the distribution of learner uptake in relation to learner variables?
3. How do students rate different types of feedback?

In the following section the study procedures and the participants are described.

3 Our study

3.1 Study participants and procedure

During the Spring semester 2003, 177 students (112 females, 65 males) from three universities across Canada participated in the study. The study participants were enrolled in one of the first three German language courses at a university level. There were 49 beginners, 105 advanced beginners, and 23 intermediates participating in the study.

[1]The exact wording of Clarification in a CALL environment certainly deserves more attention. Even the variation between 'Try again1' and 'I cannot understand.' might possibly reveal a difference in student behaviour.

[2]Elicitation could also be equated to the CALL environment with blanks, however, this might become confusing depending on the error and the number of errors in the sentence

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The online CALL program used in this study is an Intelligent Language Tutoring System (ILTS), a parser-based CALL system for German that contains a variety of exercise types for both vocabulary and grammar practice. For all exercise types, the *E-Tutor* provides error-specific feedback and additional help options in the form of a dictionary and individually tailored grammar help. For example, in case of an error the feedback includes a link to an inflectional paradigm that students can access. For a detailed description of the system, see Heift and Nicholson, 2001.

After a pre-test students used the *E-Tutor* for a period of 15 weeks. Each student completed a total of four chapters on average. Each chapter contains approximately 50 individual exercises which in total take two to three hours to complete. A final post-test and questionnaire completed the data set. The entire study was conducted online (see http://www.e-tutor.org).

For the purpose of the current study, students worked on four different exercise types: build-a-sentence, dictation, fill-in-the-blank, and translation. These exercise types were chosen because they provide a variety of tasks but, at the same time, they all use the same answer-checking mechanism for processing student input. Thus it was guaranteed that identical feedback was generated for all exercise types.

For the build-a-sentence exercise type, words are provided in their base forms and/or contain prompts and students are asked to construct a sentence. For instance, for the example given in (1), students need to provide the correct indefinite article *den* (masculine, accusative), conjugate the verb *essen*, and apply the correct word order (verb second).

(1) *er* / (indef. article) / *Apfel* / *essen*.
he / (indef. article) / apple / to eat.
Er isst einen Apfel.
He is eating an apple.

For the dictation exercise, students listen to a dialogue and type out the sentences one at a time. The fill-in-the-blank exercise type consists of sentences with a single blank where students fill in a missing word according to a prompt. For the translation exercise, students translate an English sentence into German.

For all exercises, the same tracking technology for data collection was used. Besides a unique student ID and a time stamp, the log records the entire interaction between the computer and the student. This includes the task, the student input, the system feedback, and navigation patterns in cases where students access a link for additional information relevant to their error(s) (see Heift & Nicholson, 2000 for a sample log).

3.2 Pre-test

In the pre-test we collected some background information on the study participants and assessed their knowledge of German. For background information, we elicited the following information:

1. gender
2. native language

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3. previous exposure to the German language through formal instruction or informal experience with relatives and/or visits to Germany
4. level of computer literacy

Our language skill assessment was intended to evaluate initial student placement that took place prior to students registering in the university courses. The student IDs of our log revealed in which courses students were registered.

In the pre-test, students had to respond to 24 prompts that contained vocabulary and grammar constructions from a beginner to an intermediate level. The analysis of the pre-test indicated that there were very few discrepancies between initial student placement and our assessment. However, for the purpose of our data analysis we adjusted the student level on the basis of the pre-test we administered.

3.3 Practice phase

During the practice phase, study participants used the *E-Tutor* for the entire Spring semester (13 weeks + two weeks of final exams). As they progressed through the course, they completed the exercises provided in each chapter. Students had access to the online system at any time and they could complete the exercises as often as desired.

The feedback types used in our study, *Meta-linguistic*, *Meta-linguistic + Highlighting*, and *Repetition + Highlighting* were randomly selected for each student and chapter. However, each language course consisted of at least four chapters and thus it was guaranteed that each student received each feedback type at least once. Figures 1–3 illustrate the distinctions between the three feedback types.

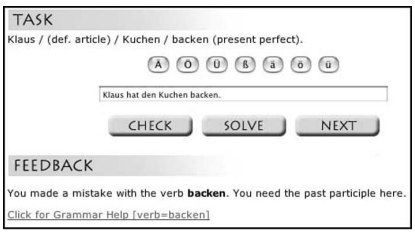


Fig. 1. Meta-linguistic feedback.



Fig. 2. Meta-linguistic + Highlighting.

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Fig. 3. Repetition + Highlighting.

3.3.1 The three feedback types

For the *Meta-linguistic* feedback, students receive a detailed error explanation. For example, for the input given in Figure 1, the feedback states that the sentence contains an error and that the past participle instead of the infinitive is needed (*Klaus has *bake* the cake). If there is a grammatical error, the *E-Tutor* also displays a context-sensitive help link that provides an inflectional paradigm. In this example, the inflectional paradigm is that of the verb *backen* (to bake).

In the event of an error, students have a number of options. The student can either correct the error and resubmit the sentence by clicking the 'CHECK' button, or peek at the correct answer(s) with the 'ANSWER' button, and/or skip to the next exercise with the 'NEXT' button. If the student chooses to correct the sentence, it will be checked for further errors. The iterative correction process continues until the sentence is correct.

Given these options, the main interest of the current study is to investigate whether, given the three feedback types, students are more inclined to revise their input by attending to system feedback, or whether they ignore system feedback by clicking the ANSWER and/or NEXT button in which case there is no learner uptake.

For the feedback type *Meta-linguistic + Highlighting*, the system response is identical to that in Figure 1, except here the student input is also displayed in the feedback section and the error is highlighted, as given in Figure 2. If there is an error, students have the same options as described for the *Meta-linguistic* feedback type.

For the final feedback type, *Repetition + Highlighting*, the student input is repeated and the error is highlighted as with *Meta-linguistic + Highlighting* above, but here the student does not receive a detailed error explanation (Figure 3). Instead, the system only provides a hint as to which main error category has been violated, e.g., a grammar vs. a spelling mistake. If there is an error, students have the same options as described for the two feedback types above.[3]

3.2 Post-test and questionnaire

The post-test contained the same format as the pre-test. While the data of the post-test is not part of the current investigation, the data was collected for further analyses of

[3]Prior to conducting our study, we experienced that, in a CALL environment, the main error category needs to be included with this feedback type because there are no examples where the error cannot be repeated or highlighted in the student input. This applies to instances where the student leaves out an entire word.

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Table 2. *Total submissions for each feedback type (Note: the distribution of correct vs. wrong submissions is fairly consistent with an earlier study (see Heift, 2002)*

Feedback Type	Meta-linguistic + Highlighting	Meta-linguistic + Highlighting	Repetition	Totals
Correct	7128 (42.1%)	7508 (43.4%)	6509 (37.4%)	21145 (41%)
Correct on 1st Try	3364 (19.9%)	3506 (20.3%)	3104 (17.8%)	9974 (19.3%)
Correction 1+n Tries	3764 (22.3%)	4002 (23.1%)	3405 (19.6%)	11171 (21.7%)
Errors	8569 (50.7%)	8610 (49.8%)	8940 (51.5%)	26119 (50.6%)
Peeks and Skips	1208 (7.2%)	1176 (6.8%)	1932 (11.1%)	4316 (8.4%)
Total Submissions	16905 (100%)	17294 (100%)	17381 (100%)	51580 (100%)

feedback in CALL. However, we also administered a questionnaire that elicited student responses on system feedback which will be discussed in section 4.3.

4 Results

4.1 Comparison of the three feedback types

For a comparison of the three feedback types, we first calculated the number of correct responses, the submissions that contained an error, and the total number of submissions for each feedback type. We further counted the number of correct responses at first vs. subsequent tries. Finally, we analyzed the log for submissions where (1) the students looked up the answer (peeks) and/or (2) skipped the exercise altogether and moved on to another exercise (skips). In both instances, no learner uptake was present. The results are given in Table 2.

Table 2 indicates that the distribution of submissions for the three feedback types is fairly balanced, with slightly more submissions received by *Repetition + Highlighting* (17381). The data further show that most correct responses were achieved by Meta-linguistic (42.1%) and *Meta-linguistic + Highlighting* (43.4%). However, we were also interested to know at which point in the correction process a correct answer was achieved. While it is not surprising that students were more successful at obtaining a correct answer after several tries, the difference between the two possibilities turned out to be minimal. This might be due to the fact that students had practised the vocabulary and grammar constructions of each chapter in the oral classroom prior to completing the online exercises. As a result, students were probably more successful at achieving a correct answer on first try.

Given the distribution of correct responses with respect to the three feedback types, it is then not surprising that Repetition + Highlighting accounted for the most errors (51.5%). However, of more interest to the current study is how students responded to an error. For this, we need to consider again the options available to students:

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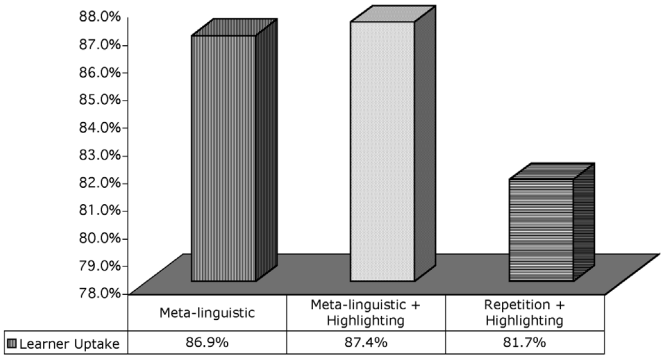


Fig. 4. With Meta-linguistic + Highlighting our study participants are most likely to correct their mistakes (87.4%) while the least learner uptake occurs with Repetition + Highlighting (81.7%)

1. Students can attempt to correct the error and then resubmit the sentence for further analysis (learner uptake), or
2. Students can choose to ignore the error and instead either look up the answer (peek) or skip the exercise altogether by moving on to the next exercise (skip). In both instances, however, there is no learner uptake, that is, no attempt at revising the input is made.

To investigate learner uptake, we then calculated the number of total submissions and

Table 3. *Results for the three feedback types (tests of within-subjects effects) (* $p < 0.05$)*

Feedback	df	F	Sig.
Sphericity Assumed	2	11.251	0.000*
Greenhouse-Geisser	1.978	11.251	0.000*
Huynh-Feldt	2.000	11.251	0.000*
Lower-bound	1.000	11.251	0.001*

Table 4. *Results for the three feedback types (pairwise comparison) (* $p < 0.05$)*

Feedback	Feedback	Std.Error	Sig.
Meta-linguistic	Meta-linguistic + Highlighting	0.013	1.000
	Repetition + Highlighting	0.012	0.000*
Meta-linguistic + Highlighting	Meta-linguistic	0.013	1.000
	Repetition + Highlighting	0.013	0.000*
Repetition + Highlighting	Meta-linguistic	0.012	0.000*
	Meta-linguistic + Highlighting	0.013	0.000*

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uptake for each study participant under each feedback condition. We subsequently applied a three-way mixed ANOVA design with gender and language proficiency as between-subject factors. The two learner variables, language proficiency and gender, will be discussed in section 4.2. The results of the means of learner uptake for each feedback type are provided in Figure 4.

The data presented in Figure 4 show that with *Meta-linguistic + Highlighting* our study participants are most likely to correct their mistakes (87.4%) while the least learner uptake occurs with *Repetition + Highlighting* (81.7%). The difference between *Meta-linguistic* feedback (86.9%) and *Meta-linguistic + Highlighting* (87.4%) is minor although it appears that highlighting has some effect on students attempting to correct their errors.

The test of within-subject effects with respect to the three feedback types, given in Table 3 indicates a statistically significant difference ($F = 11.251$; $p = 0.000$). To determine inter-group variation, a pair-wise comparison with significance level .05 revealed a significant difference between *Meta-linguistic* and *Repetition + Highlighting* (.000), and between *Meta-linguistic + Highlighting* and *Repetition + Highlighting* (.000). *Meta-linguistic* and *Meta-linguistic + Highlighting* form a homogenous subset (1.000) as displayed in Table 4.

4.2 Learner variables

Of further interest to our study are learner characteristics that might affect learner uptake for the three feedback types. For the purpose of the study described here, two learner variables are considered: language proficiency and gender.

Our study participants each belonged to one of three language skill levels: beginners, advanced beginners, and intermediates. 49 beginners, 105 advanced beginners, and 23 intermediates participated in the study. There were 112 females and 65 males.

The three-way mixed ANOVA design applied to feedback types with language proficiency and gender as between-subject factors revealed that the results are not statistically significant (see also Brandl, 1995). The results are given in Table 5.

Although the results are not statistically significant, a comparison of the means for both language proficiency and gender is, nonetheless, interesting. The results are displayed in Figures 5 and 6, respectively.

Figure 5 indicates that there is a decrease in learner uptake for all language skill levels if errors are merely repeated (*Repetition + Highlighting*) as opposed to explained (*Meta-*

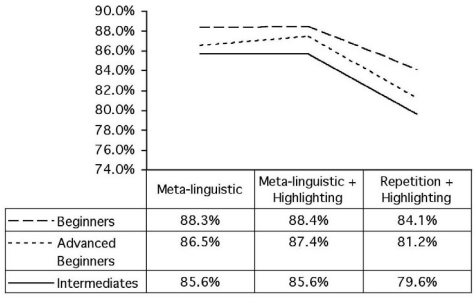
Table 5. *Tests of between-subject effects: language proficiency and gender*

Source	Type III Sum of squares	df	Mean square	F	Sig.
Intercept	137.226	1	137.226	5244.362	0.000
GENDER	8.811E-02	1	8.811E-02	3.367	0.066
PROFICIENCY	1.384E-03	2	6.919E-03	0.264	0.612
GENDER * PROFICIENCY	0.108	2	5.415E-02	2.070	0.132
Error	2.590	99	2.617E-03		

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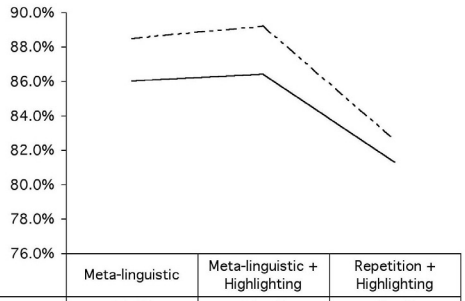
linguistic and *Meta-linguistic + Highlighting*). With respect to highlighting errors, students at the intermediate level seem to be least affected by the absence of such a feature, given that they achieved the same means for *Meta-linguistic* vs. *Meta-linguistic + Highlighting*. It is quite possible that students at the intermediate level are familiar enough with grammar explanations that such a feature makes less of a difference to them than to learners at the beginner and advanced beginner levels.

Figure 6 illustrates that both female and male students show the most learner uptake with *Meta-linguistic + Highlighting* while the biggest difference occurs between *Meta-linguistic + Highlighting* and *Repetition + Highlighting*. In general, our female study participants attempted to correct their errors less often than the male students, although the difference is not statistically significant. We also considered the language proficiency for both women and men, given in Table 6. We found, however, that the



	Meta-linguistic	Meta-linguistic + Highlighting	Repetition + Highlighting
Beginners	88.3%	88.4%	84.1%
Advanced Beginners	86.5%	87.4%	81.2%
Intermediates	85.6%	85.6%	79.6%

Fig. 5. Learner uptake by feedback type and language proficiency.



	Meta-linguistic	Meta-linguistic + Highlighting	Repetition + Highlighting
Women	86.0%	86.4%	81.3%
Men	88.5%	89.2%	82.6%

Fig. 6. Learner uptake by feedback type and gender

Table 6. *Number of women and men*

Level	Women	Men
Beginners	25%	32.3%
Advanced Beginners	60.7%	56.9%
Intermediates	14.3%	10.8%

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distribution of females vs. males with respect to language proficiency was fairly even. Thus language proficiency was not a determining factor in the differences found in men's and women's responses to corrective feedback.

4.3 Qualitative data analysis

In addition to the quantitative data collection, we also administered a questionnaire at the end of the semester. For the purpose of this study, two questions were considered:

1. Did you notice that the feedback differed in each chapter?
2. Would you prefer the most explicit feedback at all times?

The results given in Figure 7 indicate that the vast majority of study participants (91.3%) noticed that the feedback differed during system use and that most of the students (85.5%) would prefer the most explicit feedback at all times.

It is surprising, however, that 8.7% of the students did not notice the change in feedback although the log confirmed that the students, all of whom are advanced beginners, had received each of the three feedback types. It is possible that students indeed did not notice the change, or maybe misunderstood the question on the questionnaire, or likely, that student self-report in this context is not very reliable.

A more detailed data analysis revealed that the majority of the students who stated that they do not prefer the most explicit feedback at all times were at the intermediate level. It is possible that more advanced students, in particular in the case of a trivial error, prefer to solve the task by themselves without explicit feedback. While our system is capable of adjusting its feedback to a particular learner level, this functionality was disabled for the purpose of this study because we anticipated that it might interfere with the current study goals. Considering the results, however, a further investigation of the effects of scaled feedback seems necessary (see Nassaji & Swain (2000) for a discussion on feedback suited to learner expertise).

5 Discussion

The current study suggests that feedback type has an effect on learner uptake: the more

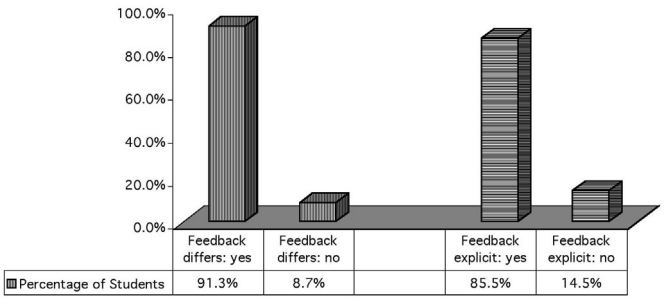


Fig. 7. Student responses from the questionaire.

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explicit and prominent the feedback, the more likely students will revise their errors in written grammar and vocabulary exercises, independent of language proficiency and gender. We believe that the testing environment of our study was very realistic in that students used the online CALL system as one of their course supplements for an entire semester. However, it remains to be investigated to what extent the results are applicable and relevant to CALL with all its different facets and applications, for example, the training of listening and reading skills.

While the emphasis of this article was not on leaner outcome, that is, the learning effects of different types of feedback, our results, nonetheless, indicate that the sparser the feedback the more errors students will commit. However, a comparison of the pre- and post-test scores might reveal whether feedback type in CALL indeed has an effect on learning outcome, although learning outcome could be influenced by many other factors such as a difference in instructional material, exercises, instructors, etc.

The main focus of this investigation was on student-computer interaction with respect to learner responses to corrective feedback. While the debate on the impact of error correction, and, more generally, the role of focus on form, is ongoing (see Ellis *et al.*, 2002), an interaction-based study tells us how students use a particular CALL program. If students are more likely to engage in a CALL program in which the interaction between the learner and the computer is enhanced, then the positive effects will probably outweigh any short-term results that might not indicate a gain in overall student performance. Here, learner motivation plays a central issue. However, as pointed out by Chapelle (2001: 74), at this point it also remains unclear "whether it is the type of feedback or the quality of resulting modified output that should be seen as valuable".

Our study also considered two learner variables: language proficiency and gender, neither of which was found to be a significant factor in student responses to corrective feedback. Intriguing questions remain open and call for further investigation:

What is the effect of other variables on learner uptake? For example, do certain error types elicit more learner uptake than others? What is the role of motivation, learning styles and learner strategies? Studies in the oral classroom, for instance, indicate that learners' attitudes have an effect on the success of corrective feedback (see Havranek & Cesnik, 2001). Similar results might be found for a CALL environment.

What is the effect of additional learner resources on student responses to corrective feedback? For example, if a CALL program provides feedback that is coupled with context-sensitive help in the form of a dictionary and/or grammar paradigms, are students less likely to be affected by different feedback types?

Our study considered interface design issues in that two feedback types included highlighting. While the effect of highlighting was not found to be statistically significant a difference in student behaviour was, nonetheless, apparent. Of further interest are studies that investigate the use of graphics and animations and their impact on learner behaviour.

Given that most CALL applications employ multiple-choice exercises, that is, student tasks that consist of a less sophisticated error-checking mechanism, how can we, nonetheless, enhance the feedback? Given Schmidt's Noticing Hypothesis, feedback coupled with additional guidance such as the implementation of lights (Levy, 1999) might be sufficient to achieve a more enhanced interaction between the student and the computer. Detailed feedback can also be manually encoded for a limited pool of tasks

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and exercises once we know which feedback type(s) are most effective for certain learners and error types.

A final question addresses the language and format of the feedback that might have an impact on student responses to corrective feedback. For example, Mackey *et al*. (2000) found that the nature as well as the content of the feedback might affect learners' perceptions of corrective feedback in the oral classroom (see also Havranek & Cesnik, 2001). Does the same apply to a CALL environment?

6 Conclusion

In this paper we presented a study in which we investigated the effects of different feedback types on learner uptake in written grammar and vocabulary exercises. Three feedback types were subject to investigation: *Meta-linguistic, Meta-linguistic + Highlighting*, and *Repetition + Highlighting*. Results indicate that study participants showed the most learner uptake for feedback that provided an explanation of the error and also highlighted the error in the student input (*Meta-linguistic + Highlighting*). A statistically significant difference between *Meta-linguistic* and *Repetition + Highlighting*, and between *Meta-linguistic + Highlighting* and *Repetition + Highlighting* was found.

Our study also considered two learner variables: language proficiency and gender, neither of which, however, was a significant factor. Nonetheless, a comparison of the means indicated that for all language skill levels and both genders, students show the least uptake with *Repetition + Highlighting*. Furthermore, for this feedback type, students committed the most errors and thus achieved the least number of correct responses.

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