

Elaborative Feedback in L2 Reading Games

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ABSTRACT

In combination with instruction, feedback can assist students in comprehension, engagement, and strategy development in second language acquisition. Outcome feedback allows learners to understand whether they are correct or incorrect. Elaborative feedback can be used to remind learners of the underlying processes behind the activities or encourage them to use learning strategies. This study is part of a European project called iRead which aims to create and test personalised learning technologies to assist primary school children in reading development. We investigate to what extent elaborative feedback, rather than solely outcome feedback, is taken up by EFL learners. Data analytics from the games will be collected, including response correctness, feedback type received, and the impact of the feedback on subsequent responses. Results will be discussed in light of both serious games and SLA theories interested in the effects of feedback on second language reading development.

Author Keywords

Serious games; feedback; second language acquisition; reading skills.

ACM Classification Keywords

J.5. Linguistics; K.3.1. Computer-assisted instruction (CAI).

INTRODUCTION

Feedback is information given to learners to allow them to evaluate their output. Corrective feedback (CF) is information given to help learners fix errors in their output and/or understanding. Based on cognitive interactionist theories of language acquisition (e.g. Long, 1996), there is a belief that CF assists learners to notice and attend to language errors in a manner that is beneficial for their long-term language development. Many studies have found that, in combination with instruction, feedback can assist students in comprehension, engagement, and strategy development. In terms of Second Language Acquisition

(SLA) feedback has frequently been investigated in terms of written CF or oral CF (see Li, 2010 for a general meta-analysis; see Lyster & Saito, 2010 for a meta-analysis of oral CF; Kang & Han, 2015 for a meta-analysis of written CF). This study focuses instead on the relatively newer subject of digital or audiovisual CF.

This research is being conducted within the iRead project, which aims to develop a suite of educational software for android tablet computers, aimed at helping children to develop their reading skills. It is currently localised into four languages – English, Spanish, German, and Greek. The software covers over 250 aspects of phonology, morphology, morphosyntax, and syntax, and consists of learning games, a graded e-reader, and an analytics application. The software is presently only available for researchers, but aims to have a public release after trials have been conducted. This study will be focusing on the use of the learning games application by 10- and 11-year-old English as a foreign language (EFL) learners in Spain, and how the feedback in those games is designed and what impact it may have on their game behavior and reading development.

These types of games are known as serious games as they are designed with a prevalent gaming element, but include the intent to improve learning (Ratan & Ritterfield, 2009), as opposed to games simply for entertainment purposes. Ritterfield, Cody, and Vorderer (2009) define serious games as intrinsically motivating because they are fun to play, but containing content that is complex enough to provide learning opportunities. This differs from ‘gamification’ as, in serious games, learning is expected to happen within the game, while in gamification the gamified elements are intended to encourage learning external to the game through greater engagement and motivation (Landers 2015). The iRead project, then, can be said to be gamifying the reading development process by introducing (among other things) a serious literacy game. Serious games are a multimodal environment where users are engaged in multiple cognitive tasks concurrently (Johnson et. al. 2017).

CORRECTIVE FEEDBACK

Rod Ellis (2010) laid out a framework for investigating CF, which can be easily adapted to include digital feedback. He listed six areas of study: type of feedback; individual difference factors; contextual factors; engagement with feedback, and learning outcomes.

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Form of feedback

Regarding *form of feedback*, researchers have proposed many categories of feedback (see e.g. Hattie & Timperley, 2007). A central distinction is between outcome feedback and elaborative feedback (Johnson et. al., 2017). Outcome feedback is simply when the learner is informed if their answer is correct or incorrect. In addition to mere knowledge of result, outcome feedback can provide direct or indirect forms of feedback (also called input-providing or output-pushing feedback). Direct/Input-providing feedback identifies what the right answer should have been (e.g. recasts), while indirect/output-pushing feedback highlight exactly where the error was made, and encourages the learner to self-correct. There is evidence (Yang & Lyster 2010, Lyster & Saito 2010) that indirect/output-pushing feedback better assists long-term development if learners have previously been introduced to the forms.

Elaborative feedback (also known as process feedback) gives learners more details, such as explaining why an answer is correct or incorrect, providing information about the specific concepts or processes involved in the task, or guiding learners to particular strategies that will help them with the task. These types of feedback are not mutually exclusive, and indeed it is difficult to give elaborative feedback without also giving outcome feedback. There is little evidence of the effectiveness of different types of feedback in serious games for SLA, and Benton et. al. (2018) found that many commercially available early literacy games contained limited elaborative feedback. However, there is some evidence from the fields of botany (Moreno, 2004) and electrical circuits (Mayer & Johnson, 2010) that providing outcome and elaborative feedback together in a game helps to develop learning more than just outcome feedback.

Complexity of feedback

One additional aspect that might be profitably explored is *complexity of feedback*. In terms of feedback complexity generally, Shute (2008) points out that there is no evidence for more complex feedback providing greater results, and some evidence that it worsens results. It seems possible that elaborative, metalinguistic feedback may be challenging to use for some lower level learners, or that these more explicit forms may be beneficial to older learners. As Li (2010) notes though, there is surprisingly little research on metalinguistic complexity of feedback.

Individual differences and feedback

Ellis also suggests *individual differences* as an area to study for CF. While there are many possible individual differences that could be explored, including age, language aptitude, gender, prior knowledge, spatial ability, and motivation, this research will target working memory. Working memory is of particular relevance due to the multimodal setting, which increases processing demands, in addition to the audio only feedback delivered (mostly) by a synthetic voice. Audio feedback is considered preferable to reduce processing demands (Johnson et. al. 2017) but

synthetic voices have been found to increase processing demands (Sinatra et. al. 2013). This all adds up to a cognitively demanding environment in which working memory may play a role in facilitating feedback use.

Engagement with feedback

Engagement with feedback is another dimension that will be investigated. Affective engagement will be studied through smaller scale studies involving think aloud protocols, as seen in Hookham et. al. (2016), in order to find out what the learners perceive from the feedback and how they feel about it, and to what extent it assists or detracts from the learning experience. Finally, behavioural engagement will be observed through the data provided by the software, to show whether, and in what way, learners take up the feedback, as demonstrated by Smith et. al. (2016).

Learning outcomes

Finally, an analysis of feedback would be sorely lacking without a measure of Ellis' final dimension, *learning outcomes*. Research from the Language and Reading Research Consortium (2015) has shown that around 90% of the variance in reading comprehension can be explained by word recognition and listening comprehension skills, both modulated by vocabulary. Using pre-, post-, and delayed post-tests, in conjunction with the data provided by the software, we will have a measure of how effective the feedback is in creating reading development gains.

There is a lack of studies on the effects of different types of feedback in the context of serious games for SLA. This is true both for within game learning (how well does the feedback help learners progress through the game) and external learning (how well has the feedback assisted the learner in their overall reading development). There is limited understanding of how learners engage with feedback in the context of serious games for SLA, and how that might be moderated by individual differences between the users, such as working memory. These are the gaps that this research project aims to help fill.

AIMS AND METHODOLOGY

The aim of this study is to gain a better understanding of the effects of feedback in serious literacy games. This will involve gathering data to attempt to answer a number of the questions posed above, such as:

- 1) In the context of serious literacy games, does outcome plus elaborative feedback lead to better in-game results than outcome feedback alone?
- 2) Are different types of elaborative feedback taken up differently by learners playing serious literacy games?
- 3) Do individual differences in working memory affect uptake of elaborative feedback by learners playing serious literacy games?
- 4) How do 10- and 11-year-old users of serious literacy games engage with the feedback provided to them on a cognitive, affective, and behavioural level?

The primary data collection for the iRead program will consist of one academic year's worth of use of the system, for at least one hour a week, by several classes of 10- and 11-year-old EFL learners in Spain.



Figure 1. iRead literacy games with both outcome and elaborative feedback

Several variables will be involved in the research. Type of feedback will be an independent variable. Working memory and engagement will be moderating variables.

The dependent variables will fall into two categories: data internal to the system, and data external to the system.

Measures

Internal measures will include data on which features and games learners are using, errors and error recovery, and timing of responses. These will allow us to judge the effectiveness of the feedback, and whether the different types are taken up in different ways. External measures will be assessed with a pre/post-test design, which will allow us to measure reading development and motivation. At the start of the academic year, all students taking part in the project will be given pre-tests, including tests of:

- 1) Reading skills, including measures of word and non-word recognition, listening comprehension, and oral reading fluency in L1 and L2.
- 2) Vocabulary size, as measured by a children's productive vocabulary test developed by Anthony and Nation (2017).
- 3) Working memory, as measured by a backwards digit span.
- 4) A questionnaire gauging individual motivation for learning English, reading, and using learning games.

Twice during the year, learners will complete interim engagement questionnaires with additional questions specifically relating to the application they have been using. At the end of the academic year, students will undergo post-tests covering all the topics mentioned above in order to assess development over time.

To investigate cognitive and affective engagement, smaller samples of students will be taken out from their classrooms

for additional study, including the use of think-aloud protocols, or using the application under feedback/no feedback conditions for a short period of time.

Additionally, one or two classes of students at the same grade level but who will not be using the system (but rather taking part in their regular reading development activities) will also undergo the pre- and post-tests in order to serve as a control group.

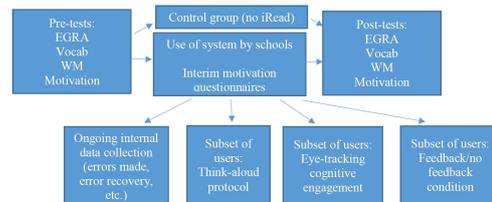


Figure 2. Study design

Outcome feedback in the game is presented in numerous ways, including visual indicators (e.g. a bridge breaking) and as oral speech (e.g. "Great job!"). Elaborative feedback is all presented orally to the learner when they make an error. By undertaking (primarily) classroom research with a commercial quality application, the study will have strong ecological validity. In addition, the large numbers of participants involved and constant digital data collection will help to strengthen any findings.

CONCLUSION

This is an ongoing study and as such does not yet have final results. However data collection has already begun and there are some emerging trends from the pilot testing and early data. In general, the elaborative feedback is not proving to be more effective than simple outcome feedback. The 10- and 11-year-old learners in the study are largely seen to ignore longer feedback explanations and make second attempts before the elaborative feedback has finished playing. In early think-aloud sessions, participants regularly refer to the outcome feedback (e.g. tiles turning red or green) as helping them understand their progression through the topic, but rarely mention using the longer audio hints. This finding is in contrast to those of Moreno (2004) and Mayer & Johnson (2010). A possible explanation for this is to do with the age of the participants – our learners are primary school children rather than university students.

Another preliminary finding relates to the primacy of mechanics over language. Many participants struggle initially with some of the game mechanics and make numerous non-language errors. On the other hand, by their third game trial, learners seem to take actions by finding mechanical similarities with previous trials, rather than due to understanding and utilizing the target language points.

Further data and analysis will be available for discussion at Gamilearn'19.

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