The Effects of Corrected-Errors in Asynchronous Video Based Lessons on Task Efficiency

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Abstract: This study explores the impact that student exposure to instructor made corrected-errors can have on their pedagogy through the use of asynchronous video-based lessons. We define corrected-errors as segments in the lesson where the instructor makes an error, identifies that an error has been made, and then goes on to correct it. Our study measures the learners’ performance on a similar task by looking at the efficiency in which that task is carried out. We hypothesize that the modeling of error detection and correction skills when coupled with the instructor’s explicit meta-cognitive explanation and reflection of errors, will lead to an increase in efficiency.

Introduction
This study explores the impact that student exposure to instructor made corrected-errors can have on their pedagogy through the use of asynchronous video-based lessons. Asynchronous video-based lessons are prerecorded instruction that the viewer can watch on demand. We define corrected-errors as segments in the lesson where the instructor makes an error, identifies that an error has been made, and then goes on to correct it (Antonios Saravanos, 2008a). Our study measures the learners’ performance on a similar task by looking at the efficiency in which that task is carried out. We hypothesize that the modeling of error detection and correction skills, especially when coupled with the instructor’s explicit meta-cognitive explanation and reflection of errors will lead to an increase in efficiency.

Theoretical Framework
Originally psychologists such as (Thorndike, 1927) and (Skinner, 1968) asserted that any erroneous knowledge that is taught by the instructor to the learner would have to be unlearnt before the correct information could be taught. However, this notion was to change when (Fisher & Lipson, 1986) stated that errors are only undesirable when they deter a student from learning the material thus expanding on the notion that errors could possibly have a place in pedagogy. Their belief was founded on the idea that the learning of meta-cognitive skills could have a positive effect on future performance. This notion was further built on by (Marcone & Reigeluth, 1988) who extended on this idea by investigating the effects that teaching students about common errors would have on their pedagogy. A plethora of studies have been conducted that provide evidence that error training can have positive effects on learning (Berkson & Wettersten, 1984; Chillarege, Nordstrom, & Williams, 2003; Gully, Koles, Payne, & Whiteman, 2002; Ivancic & Hesketh, 1995). However little research has been conducted looking at the effect of errors in asynchronous video based lessons (A. Saravanos et al., 2008).

Method
A three group post-test only experimental design was used to study the aforementioned hypothesis and was adapted from (Antonios Saravanos, Paek, & Kuwata, 2009) and (Antonios Saravanos, 2008b) to look at the ways in which a corrected-error could appear in instruction and its effect on learner efficiency on transfer activities. The two ways in which a corrected-error could appear in instruction were with and without explanation as to the instructor’s error detection and correction process. A third group that did not contain any corrected-errors was used as a control to determine the effect of the errors. Three instructional videos were then designed to teach novices how to use a Web Development Environment to create web pages. The Web Development Application that was chosen was Macromedia Dreamweaver 8.

Participants
The participants in this study were graduate students studying in the New York City area. Participants were asked to only participate if they did not have any prior experience utilizing a Web Development Application.

Design of the Videos (Independent Variable)
In the first video, that represents instruction that contains no errors (NE) the instructor covers the steps needed to create a webpage in Dreamweaver 8. In the second video that represents instruction that contains corrected-errors (CS) the teacher covers the same curriculum but completes the task with five errors that are often made during the process and corrects the errors without any explicit explanation and reflection on how s/he learns from those errors. The third video contains corrected-errors followed by the instructor's meta-cognitive
knowledge (CW), the teacher covers the same curriculum with the same five errors in video one while demonstrating the process of detecting, correcting errors and explicitly explaining the troubleshooting process and reflecting on how they learn from those errors. The videos were created by taping the CW lecture and then editing the footage to achieve the CS and NE lectures. A screen capture showing what an example of how the lesson looked can be seen in Figure 1.

![Figure 1](image.png)

Figure 1. Screen capture from one of the video lessons.

**Procedure**

A series of experiments were performed to measure the effect of the irregular instruction on learner interaction and performance. Experiments were held in a quiet room that would resemble the same conditions as would be experienced by a person learning through asynchronous instruction at home. The control group and the two experimental groups watched video 1 (NE) and videos 2 (CS) and 3 (CW), respectively. All necessary materials such as pictures and texts were provided. They were allowed to pause, rewind the video and take notes.

Following the viewing of the video each participant was required to complete an exercise task, which was similar with the one in the movie. The following steps took place:

1. The experimenter provided the participant with a laptop containing one of three aforementioned videos to watch. Participants were allowed to spend up to one and half hours to watch the video, and were told that they may pause, rewind, or fast-forward the video as desired.
2. Participants were then asked to try and solve a transfer problem that required them to create a simple web site using the techniques that had been taught in the lesson.

**Measures (Dependent Variable)**

Student performance was measured by observing the number of errors that each participant made on the transfer activity, their detection of any errors, and their ability to correct any errors that were detected. An efficiency score was calculated from those observations where 0 represented the lowest score possible and most inefficient performance on the transfer activity. Conversely 15 represented the most efficient performance on the transfer activity.

**Results**

The results are categorized in two areas: transfer activity efficiency and participant ability to detect and correct errors on the transfer activity.

**Transfer Activity Efficiency**

A one-way analysis of variance showed that learner performance on the transfer task was significantly affected by the addition of both types of CE into the instruction, F(2, 48) = 7.630, p = .001. The mean scores and variances can be seen summarized in Table 1. These results showed that learning varied between the groups.
with a possible minimum score of 0 and a maximum score of 15. The NE group had a mean score of 11.470 and a standard deviation of 2.125, the CS group had a mean score of 7.240 and standard deviation of 4.131, and the CW group had a score of 10.180 and a standard deviation of 3.147. The minimum score that was observed were 6, 0, 5, and the maximum score were 14, 15, 15, for Groups NE, CS, and CW respectively.

Table 1: A summary of the efficiency scores on the transfer activity by group.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Std. Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>NE</td>
<td>17</td>
<td>6</td>
<td>14</td>
<td>11.470</td>
<td>2.125</td>
</tr>
<tr>
<td>CS</td>
<td>17</td>
<td>0</td>
<td>15</td>
<td>7.240</td>
<td>4.131</td>
</tr>
<tr>
<td>CW</td>
<td>17</td>
<td>5</td>
<td>15</td>
<td>10.180</td>
<td>3.147</td>
</tr>
</tbody>
</table>

To ascertain which groups’ performance differed three independent t-tests were carried out. When comparing the scores between the NE and CS groups, the Levene’s Test for Equality of Variances yielded an F-score of 6.308 (p = 0.017). Therefore, an equal variance was not assumed for the two groups. The t-test produced a t-score of 3.759 (p = 0.001) that was significant. When comparing the scores between the CS and CW groups, the Levene’s Test for Equality of Variances yielded an F-score of 0.957 (p = 0.335). From these results we assumed an equal variance for the two groups. The t-test yielded a t-score of -2.335 (p = 0.026) that was significant. When comparing the scores between the NE and CW groups, the Levene’s Test for Equality of Variances yielded an F-score of 3.487 (p = 0.071). Again from the results we assumed an equal variance for the two groups. The t-test yielded a t-score of 1.405 (p = 0.171) that was almost significant.

![Figure 2](image)

Figure 2. This chart displays the mean transfer activity efficiency by group.

**Ability to Detect and Correct Errors**

The learners’ awareness of their activities during the duplicate task was also affected positively as can be seen in Table 2 in the lower part of the middle column. In this table each of the five categories of possible errors are listed individually along with the number of participants that made that error, whether the participants were able to detect the errors they had made, and whether they were finally able to correct an error. Participants in the NE group that contained the regular instruction without corrected-errors and instruction including explanation and reflection initially made only 40% of possible errors; were able to detect 26.7% of those errors; and were then able to correct 26.7% of those errors; getting 90.7% of the correct by the end of the activity. In contrast participant that where in the CS group and had seen the instruction that contained corrected-errors but did not contain the instructors reflection and explanation initially made 69.3% errors; detected 48% of those errors; and then corrected 46% of those errors and had 65% errors corrected by the end of the transfer activity. Lastly, those in the CW group that contained corrected-errors and the instructors reflection and explanation initially made only 38% of possible errors; detected 34% of those errors; and went on to correct 72.4% of the errors.
Table 2: This table shows a summary of group performance on the transfer task.

<table>
<thead>
<tr>
<th></th>
<th>Made</th>
<th>Detected</th>
<th>Corrected</th>
</tr>
</thead>
<tbody>
<tr>
<td>NE</td>
<td>40%</td>
<td>26.7%</td>
<td>26.7%</td>
</tr>
<tr>
<td>CS</td>
<td>69.3%</td>
<td>48%</td>
<td>46%</td>
</tr>
<tr>
<td>CW</td>
<td>38%</td>
<td>34%</td>
<td>72.4%</td>
</tr>
</tbody>
</table>

Conclusion
The study demonstrates that the inclusion of corrected errors within asynchronous video based lectures does have an impact on student efficiency indicating the effects that (Skinner, 1968) and (Thorndike, 1927) were afraid of occurring. However, the addition of explicit explanation and reflection after each of the errors led to a negation of those effects. Learners that were in the group that had received access to the instructor metacognitive information had almost the same efficiency as those in the control group who had not been exposed to any corrected-errors, as can be see in Figure 2. Moreover, those in the group that had been exposed to corrected-errors had a higher probability of correcting their own errors as can be seen in Table 2. Therefore one can assert that the modeling of corrected-errors in asynchronous video-based lessons leads to an increase in student ability to detect and correct their own errors. The addition of explicit explanation leads to an improvement in efficiency.

References