Using Diagrams in Writing Explanations: How Crucial is Instruction for Such Use to be Beneficial?

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Abstract. The purpose of this study was to examine (1) the benefits, or otherwise, of asking students to use a diagram in writing explanations of what they have learned, and (2) the extent to which instruction and practice may be necessary for such use to be beneficial. The participants were 45 undergraduate university students for whom English was a foreign language (EFL). Many EFL students experience some challenges in communicating in the language they are learning, so these students were deemed ideal as participants for this study. Data were collected in three phases, during each of which the students were asked to read a passage and then construct an explanation of it in English. In Phases 2 and 3 they were asked to include at least one diagram in their explanation and, prior to Phase 3, they were provided instruction and practice in the use of various kinds of diagrams. Results revealed that representation of key points in text generally decreased, while representation in diagrams increased. More importantly, the combined number of key points represented in the explanations increased across the three phases. However, there were indications that the kind of diagram required mattered, and that students may need more instruction and practice in the construction of more abstract diagrams (e.g., arrays in tables).

Keywords: Self-Constructed Diagrams, Instruction in Strategy Use, Written Communication in a Foreign Language.

1 Introduction

To date, the majority of educational research on diagram use have examined the effectiveness of *provided* diagrams (i.e., students are provided the diagrams to use rather than constructing their own). Relatively fewer studies have focused on *self-constructed* diagrams, and those have shown mixed results, with some showing positive outcomes [1, 2] while others have less favorable results [3, 4]. A possible reason for the negative outcomes may be that students simply lack adequate knowledge and skills in diagram use, especially as those are rarely taught in schools [5].

The present study sought to clarify the way and extent to which self-constructed diagrams could benefit or otherwise the efficacy of students' written communication.

Students with English as a foreign language (EFL) were selected as participants as such students tend to experience more challenges when writing in the foreign language (in this case, English). Hence, the possible benefits/impact of diagram use might manifest more saliently. The specific research questions were:

(i) Would EFL students be able to encode more of the key points they have learned if they are asked to include a diagram in the explanations they produce?

(ii) Would instruction matter (i.e., would they show sufficient improvements in key points encoded even if they are not taught how to use diagrams for such purposes)?

2 Method

The participants were 45 EFL undergraduate students in 3 equivalent classrooms in a university in China; all were at the "intermediate" level in English ability. None had received any formal instruction on diagram use. In Phase 1, they were asked to read a short passage and to take notes. They were then asked to construct an explanation in English of the information they have read, without any instruction on how to provide the explanation. They could refer to their notes, but not the original passage. In Phase 2, the passage was different, but the procedure was the same – except the students were asked to include at least one diagram in their explanation. Between Phase 2 and Phase 3, the students were given instruction and practice in three 45-minute sessions over 3 days on how to use diagrams in constructing explanations. In Phase 3, the passage was again different, but the procedure was the same as in Phase 2.

To check whether any changes in quality of explanations might have been affected by the passages used, three equivalent passages were prepared (with the same number of key points), and a third each of the students received them in three different sequences (i.e., 1-2-3, 2-3-1, 3-1-2). For each of Passages 1–3, the types of diagrams deemed appropriate for explaining were illustration, schema, and table, respectively.

A paid research assistant scored the students' explanations, using rubrics to identify text and diagrammatic representation of pre-determined key points. With another scorer, inter-rater agreements were .81 for text and .985 for diagram representations.

3 Results

The mean scores in representation of key points in text, diagrams, and in combination are shown in Figure 1. No passage effect was found, meaning that overall responses to the three passages did not significantly differ. Mean text representations decreased across the phases (i.e., 1 > 2 > 3), $F(2, 42) = 10.05$, $p < .001$. In contrast, diagrammatic representations increased across the phases (i.e., 1 < 2 < 3), $F(2, 42) = 180.49$, $p < .001$. Perhaps more importantly, the combined text and diagrammatic representations increased across the phases ($F(2, 42) = 22.01$, $p < .001$). There were also significant passage and phase interaction effects ($F(4, 84) = 4.02–6.57$, $p < .01$), evident in the Figure 1 graph fluctuations. An examination of the performance results showed lower representation of key points in schemas and tables (more *abstract* diagrams) compared to illustrations (more *concrete* diagrams), before – and even after – instruction.

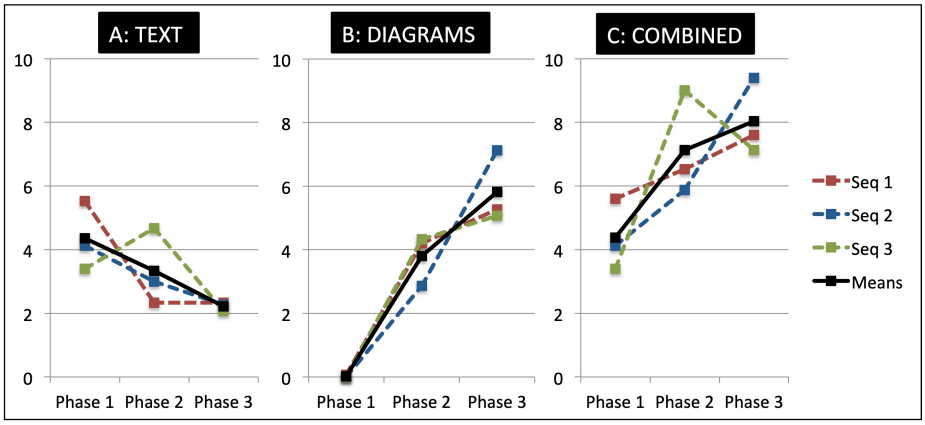

Fig. 1. Participant scores on key points representation in text, diagrams, and in combination, for the three sequences (and means) across the three phases.

4 Discussion and Conclusion

When students were asked to include a diagram in their explanations, they were generally able to represent more of the key points they had learned – even *before* they received explicit instruction and practice in diagram use. However, following instruction and practice, they were able to represent even more key points in diagrams (see Panel B of Figure 1). Decreases in text representation did not negatively impact the number of key points the students were able to include/convey in their explanations. These results support arguments for the value of cultivating diagram construciton skills for enhancing communicative efficacy [5]. However, as noted, more instruction may need to be devoted to the use of more abstract diagrams.

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