Improving Visual and Verbal Information Integration in Mathematics Textbooks

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INTRODUCTION

Like many math textbooks, *Connected Mathematics 2* has a wide variety of visuals.

We sought to improve the integration of visual and verbal information in modifying the CMP2 books.

We based these modifications on three cognitive principles: signaling, contiguity, & coherence (Mayer, 2009) .
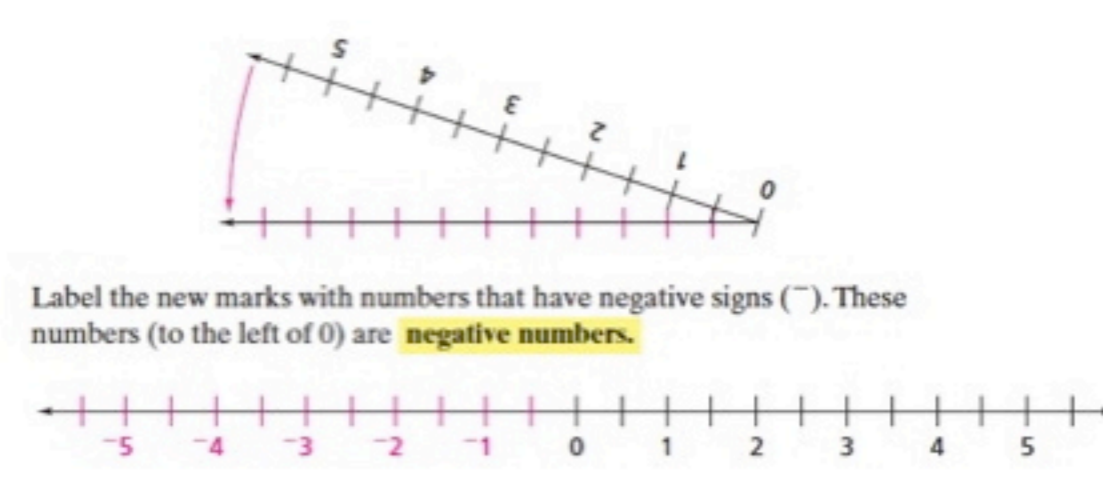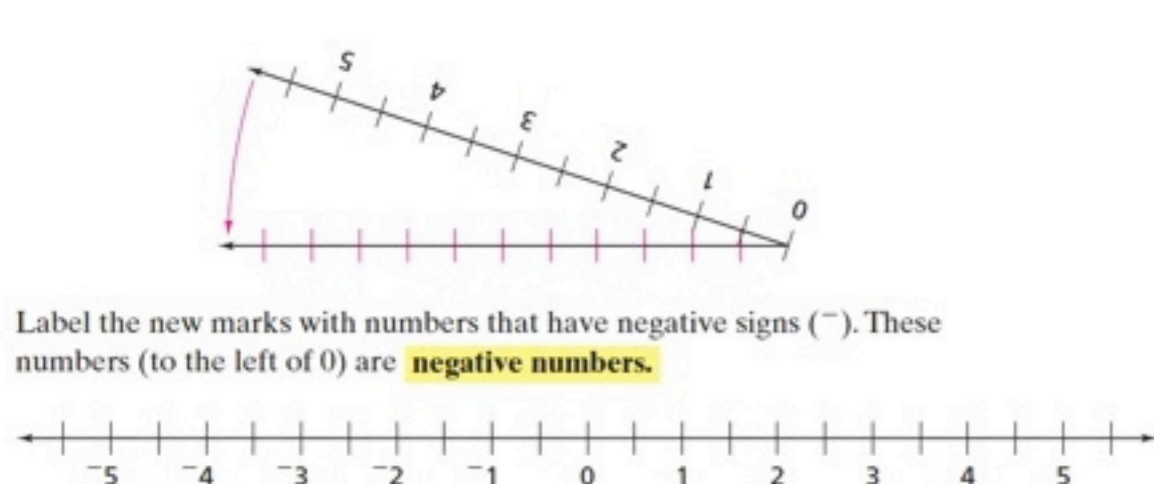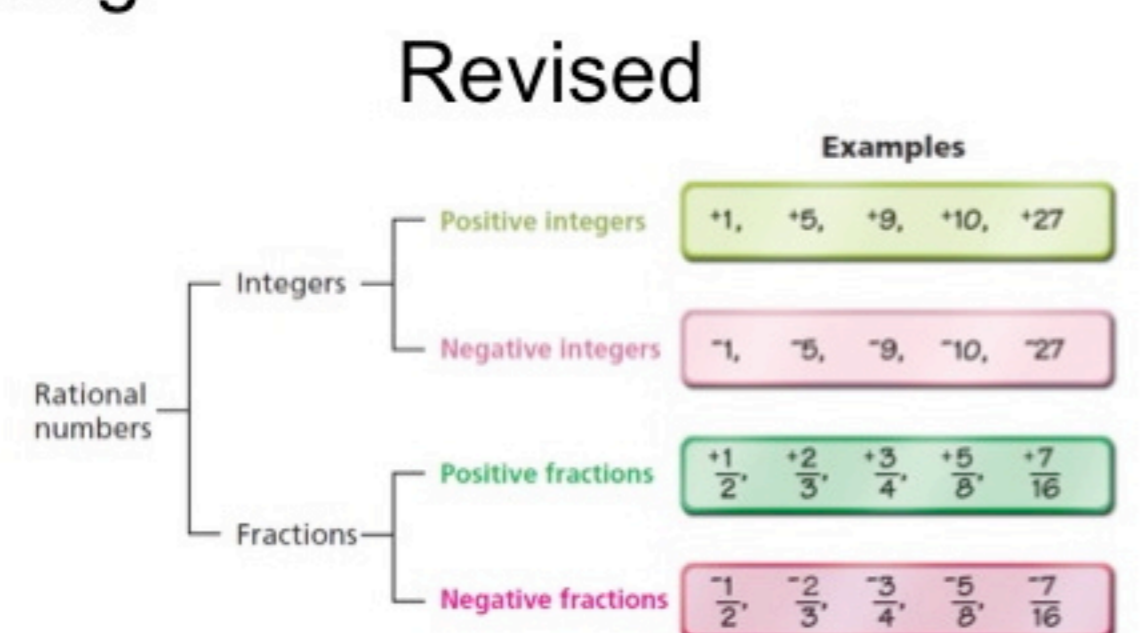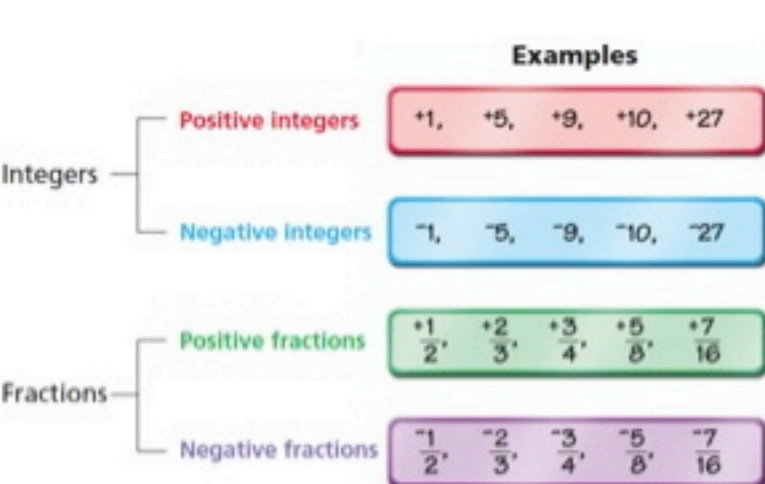
Now we are in the process of empirically testing these modifications to determine their effectiveness.
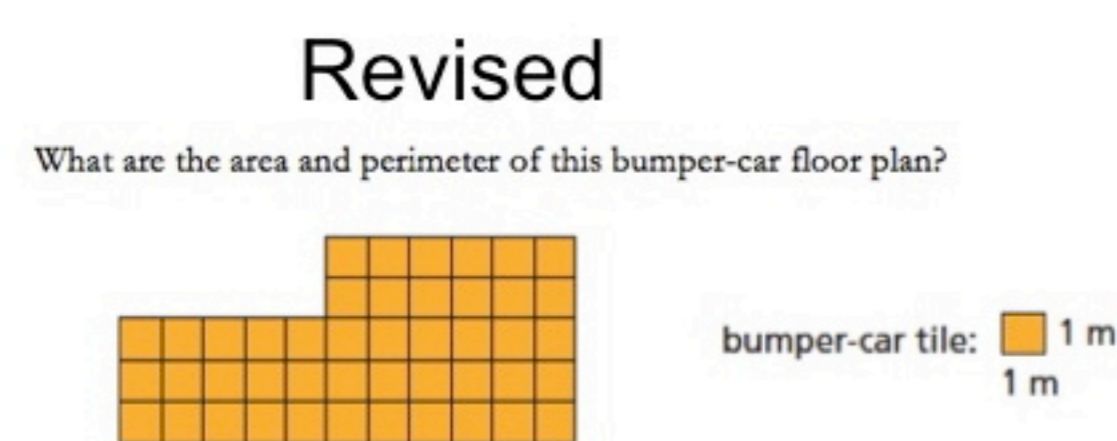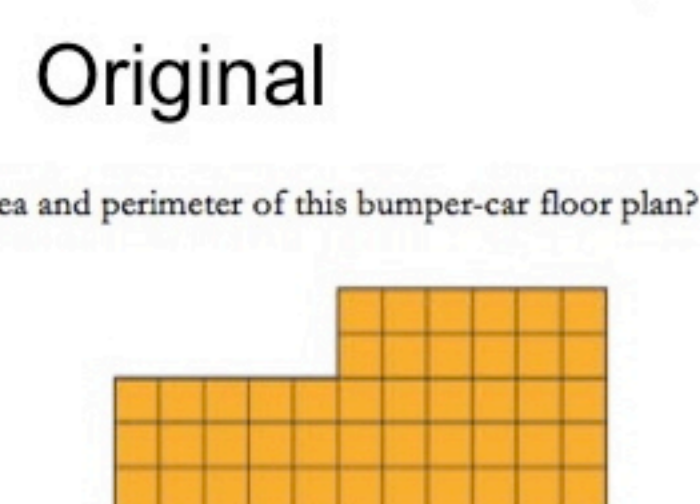

Signaling Principle

Learning is improved when there are cues to important information (Kalyuga, Chandler, & Sweller, 1999; Koning, Tabbers, Rikers, & Paas, 2009).
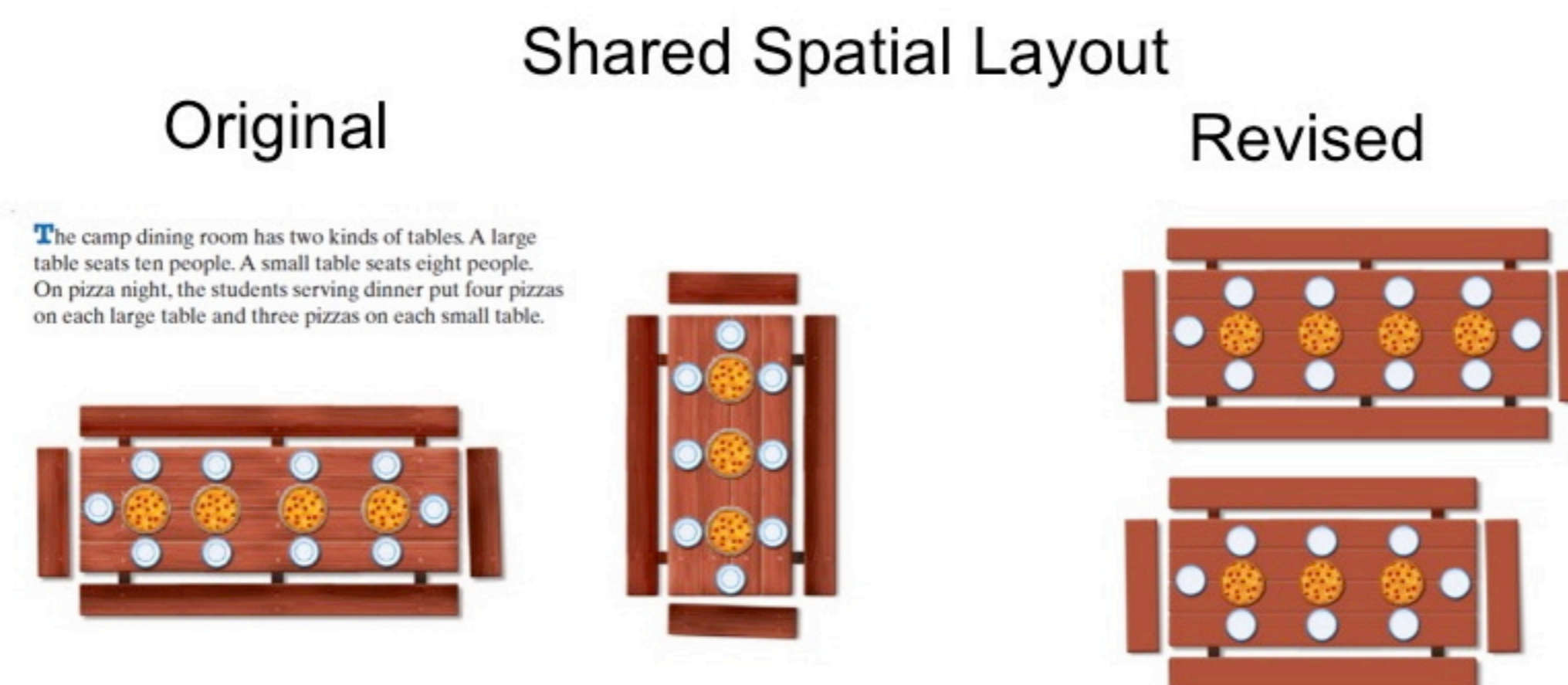
Color Coding

Original

Revised

Adding Missing Information

Original

Revised

bumper-car tile: 1 m / 1 m

Contiguity Principle

Learning is improved when multiple representations are aligned along important features (Ginns, 2006; Mayer, 2002).

Shared Spatial Layout

Original

Revised

The camp dining room has two kinds of tables. A large table seats ten people. A small table seats eight people. On pizza night, the students serving dinner put four pizzas on each large table and three pizzas on each small table.

Spatial Contiguity

Original

The problems and the table necessary to solve the problems are on different pages.

Revised

Integrate Verbal and Visual Information
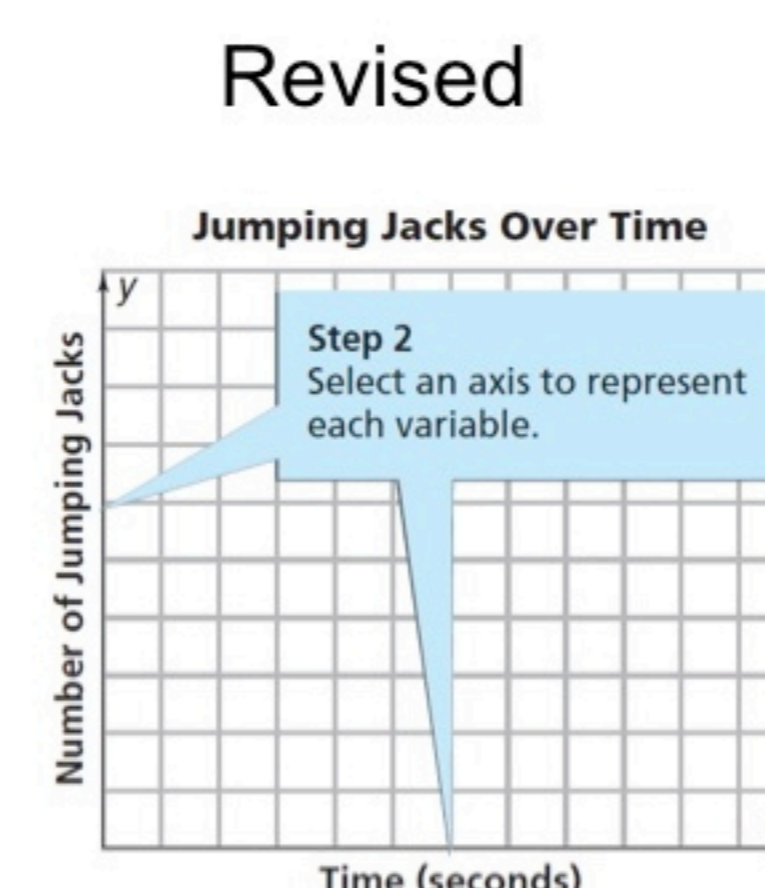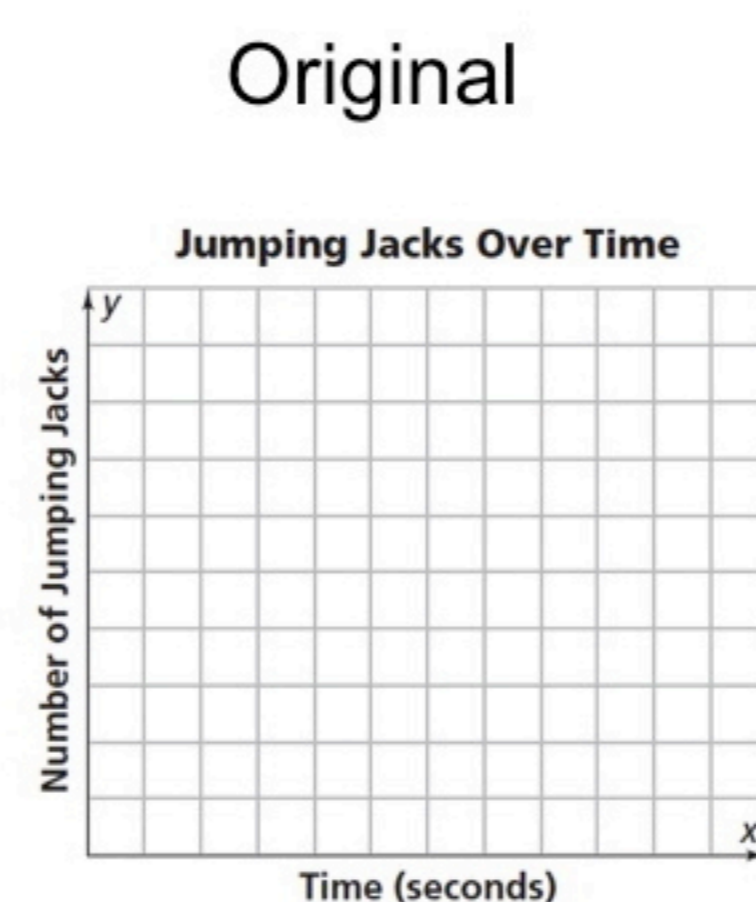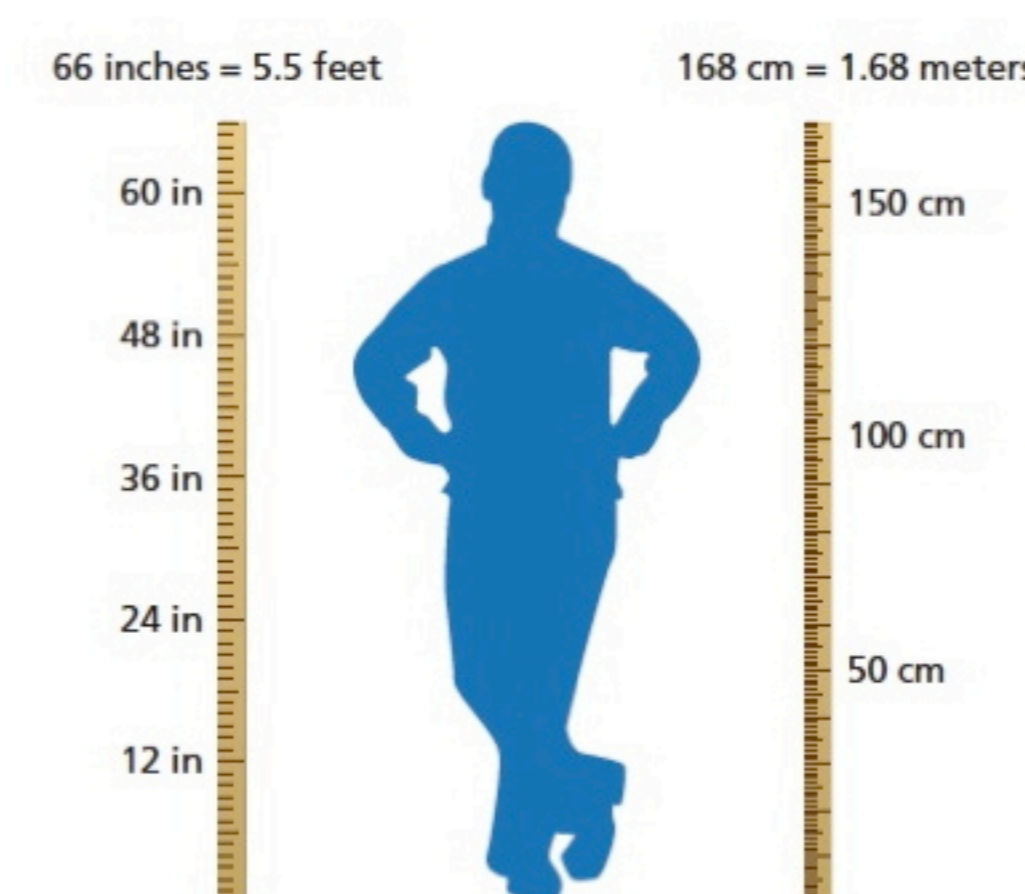
Original

Revised

Coherence Principle

Learning is improved when interesting, but irrelevant words and pictures are removed (Harp & Mayer, 1998; Mayer, 2002).

Replace Math-Irrelevant with Math-Relevant

Original

Revised

Coherence Principle (continued)

Remove Seductive Details

Original

Revised

Empirical Tests

Two experiments to examine the effects of the revisions: Problem solving and lesson reading.

Problem solving:
- 50 seventh-grade students
- 8 story problems (4 revised and 4 original; between and within subjects)
- Revisions did not affect problem-solving accuracy
- Revisions also did not affect student's reports of their level of interest, confusion, or perceived difficult
- Problem solving may involve different processing than does reading lessons.
- More research needs to be done to reconcile these findings with others on the seductive details effect.

Lesson reading:
- In progress with sixth- and seventh-grade students
- Read lesson (original or revised) while eye movements were recorded, wrote recall, solved problems
- Preliminary eyetracking data indicate revised lessons were easier to read than original lessons.

The findings from these experiments will contribute towards refining cognitive principles for future revisions.