Interpreting graphs and tables with cognitive tools

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Recommended Citation
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Interpreting graphs and tables with cognitive tools

A Thesis submitted in fulfilment of the requirements for the award of the degree of Doctor of Philosophy (PhD)

from

The University of Wollongong

by

Brian Ferry


Faculty of Education

1997
Declaration

I certify that this is my original work and that it has not been submitted for a degree at any other university or institution.

Brian Ferry
24.3.97
Acknowledgments

I wish to acknowledge the guidance, encouragement and support provided by my supervisors, Associate Professor Barry Harper and Associate Professor John Hedberg.

There are always many others to thank during a project such as this. First, I would like to thank the preservice teachers who took part in this study. Second, I would like to thank Sean Cruickshank, Peter Gracie, Matthew Fifield and Rob Wright for their technical assistance. Also I wish thank my colleagues Christine Brown and Peter Keeble who have provided valuable input at various stages of this study.

Last, but certainly not least, I wish to thank my family Chris, Michelle and Belinda for putting up with the constant talk about this study and the long periods of time that I spent working on this project.
Abstract

This study explores some ways in which cognitive tools may be used to assist learners to interpret graphs and tables. It investigates ways in which concept mapping tools may be applied to this task, and then it investigates how preservice teachers used a suite of simple cognitive tools designed to reduce cognitive load. All cognitive tools were developed with HyperCard™ software and these tools were used by preservice teachers (the subjects of this study).

The thesis is divided into three linked studies. Study 1 investigated the cognitive strategies employed by preservice teachers when they interpreted graphs and tables. The findings were then used to guide the design of the cognitive tools that were used in Study 2.

During Study 1 the ability of various groups of preservice teacher to interpret graphs and tables were compared. The findings showed that when these learners interpreted graphs and tables they had difficulties with understanding the context as described by the accompanying text, sorting and comparing relevant data in tables, and identifying specific global (e.g. slope, turning points, discontinuities) and local features (e.g. labels on axes, points on graphs) that were relevant.

During Study 2 a prototype of the cognitive tools was developed and trialled. These tools were designed to assist learners to interpret information in form of text, graphs and tables that related to the destruction of rainforests. During Study 3 the improved cognitive tools were used by 80 preservice teachers. Interviews, artefacts and tracking data were gathered and used to evaluate the tools.

The findings from all data sources suggest that there are procedures that we should employ to effectively introduce learners to cognitive support tools, as it is not just a matter of designing a suitable tool and then handing it over to the learner to use. Analysis of the concept maps and interview transcripts showed that the learners used one of three strategies to construct their concept maps, but in most cases there was little difference in the quality of the final map produced. It appears that one strength of the concept mapping tool was that it helps learners to visually organise knowledge in different ways. Also the other cognitive tools may have acted as mental devices that supported, guided and extended the thinking processes of learners.
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