Supporting the Construction of Qualitative Knowledge models
Bessa Machado, V.

Citation for published version (APA):
Bessa Machado, V. (2004). Supporting the Construction of Qualitative Knowledge models

General rights
It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

Disclaimer/Complaints regulations
If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: http://uba.uva.nl/en/contact, or a letter to: Library of the University of Amsterdam, Secretariat, Singel 425, 1012 WP Amsterdam, The Netherlands. You will be contacted as soon as possible.
## Contents

**Preface**  

1 **Introduction**  
1.1 Modelling as means of problem-solving ........................................ 1  
1.2 Conceptual Modelling using Qualitative Reasoning .......................... 2  
1.3 Graphical Representations in Problem Solving .............................. 3  
1.4 Support in articulating knowledge ............................................. 4  
1.5 Research Goals ........................................................................... 4  
1.6 Outline of the Thesis .................................................................... 4  

2 **Designing a Model Building Environment** ........................................ 7  
2.1 Introduction ................................................................................. 7  
2.2 Analysing the Model Building Process ........................................ 10  
2.3 Designing Modelling Tools ......................................................... 28  
2.4 Summary ..................................................................................... 45  

3 **The HOMER Experiment** ............................................................. 49  
3.1 Introduction .................................................................................. 49  
3.2 Subject Matter: The U-Tube System ............................................. 51  
3.3 HOMER Environment ................................................................... 51  
3.4 Method ......................................................................................... 57  
3.5 Experiment Results ....................................................................... 58  
3.6 Summary and Concluding Remarks ............................................. 76  

4 **Enabling Support in Building Models** .......................................... 79  
4.1 Introduction .................................................................................. 79  
4.2 Related Educational Software ...................................................... 80  
4.3 Lessons learned regarding interface and interaction design ............ 90  
4.4 Feedback on errors ...................................................................... 93  
4.5 Lessons learned regarding feedback on errors .............................. 96  
4.6 Support Designing for the Learning Process ................................. 97  
4.7 Our approach to the new support system .................................... 99  
4.8 Discussion and Conclusions ......................................................... 106
5 Design and Implementation of MOBUM
  5.1 Introduction .................................................. 109
  5.2 System Architecture ......................................... 110
  5.3 User Interface ................................................ 116
  5.4 User interface implementation ............................. 129
  5.5 Discussion and Conclusions ................................. 139

6 MOBUM Experiment
  6.1 Introduction .................................................. 141
  6.2 MOBUM Evaluation ............................................ 142
  6.3 Results of the MOBUM Evaluation ......................... 144
  6.4 Comparison Study between MOBUM and HOMER .......... 157
  6.5 Discussion and Conclusions ................................. 168

7 Conclusions and Discussion
  7.1 Main Results .................................................. 171
  7.2 Future Developments ......................................... 175

A The Scuba Diving Model
  A.1 Hierarchy ..................................................... 177
  A.2 Model Fragments .............................................. 177
  A.3 Scenarios ..................................................... 185
  A.4 Quantity Spaces .............................................. 187

B Homer Experiment
  B.1 Assignment - Part 1 ........................................... 189
  B.2 Assignment - Part 2 ........................................... 189
  B.3 Reflection with the model builder ....................... 194

C MOBUM Experiment
  C.1 Novices assignment - Garfield's weight ................ 195
  C.2 Experts assignment: Construct a simulation model of a U-Tube 196
  C.3 Comparison Study: MOBUM - HOMER ...................... 196

Summary ............................................................. 217

Samenvatting ....................................................... 221