Ecolab: Exploring the Construction of a Learning Assistant

Rosemary Luckin
School of Cognitive and Computing Sciences
University of Sussex
Falmer
Brighton
BN1 9QH
phone: +44 (0)1273 678647 (direct) or 678195
fax: +44 (0)1273 671320
e-mail: rosel@cogs.susx.ac.uk

Abstract. The Ecolab is an interactive learning environment constructed with the aim of providing a tool to investigate how software can offer help and support to an individual learner. The design framework is informed by Vygotsky’s Zone of Proximal Development (ZPD) and previous work on face to face tutorial assistance. Three Ecolab versions implement different variations and combinations of design features with the purpose of providing a means of evaluating what constitutes effective assistance. The evaluation of the system illustrates that the differing qualities and quantities of collaborative assistance offered by the three system variations influenced both the child user’s learning gain and the nature of her interactions with the system. It also highlights the impact which each user's ability and learning style has upon their experiences with an interactive learning environment.

1 Introduction

The Ecolab software described in this paper consists of a trilogy of system variations designed around the common theme of providing collaborative assistance in an interactive learning environment with which children aged 10 and 11 years can investigate food chains and webs. The theory of instruction which underpins the design framework is inspired by the Zone of Proximal Development (ZPD) concept [7] [8]. This theory has been interpreted and formulated into a software design framework (for a full description of this framework and its implementation within the Ecolab see [4]). Each system variation implements different aspects of this underpinning framework to provide collaborative support and to adopt the role of a more able learning partner. The purpose of the three variations is to allow evaluation of the design framework. The ZPD provides a theoretical fabric within which an investigation into the nature of collaborative support and assistance can be constructed. The problems addressed by this paper are the specification of what it means for one party to assist another in the process of learning and the

© Springer-Verlag Berlin Heidelberg 1998
implementation of this specification within educational software design. The aim is to demonstrate the possibilities offered by software design which integrates a collaborative or partnership role for the computer with an effective instructional theory.

2 The Nature of Collaborative Assistance

One way to investigate how the computer can play the role of a learning partner is to consider how face to face assistance is offered to learners. Wood [9] coined the term "scaffolding" to describe tutorial assistance. Effective scaffolding is presented as something more than the provision of hints and graded help. It represents one way of pinning down the nature of the assistance that teachers can provide for children as they learn, it is not however a straightforward process. Before scaffolds can be constructed, or even planned, a careful analysis of the domain, indicating potential links to the child's existing, intuitive knowledge is essential [1]. In order to explicate a framework within which a more able partner assists a less able one, attention needs to be paid to more than help interventions [5].

The notion of scaffolding has been used in the development of educational software in various ways [10] and [2] for example. Model-It [2] and McBagal [3] are examples of computer based scaffolding which side-step some of the problems associated with the limited ability of computers to create social interactions, by concentrating upon the authenticity and grounding of the problem domain, the structuring of its presentation or the use of the computer to support human collaboration. In contrast, the EXPLAIN [10] developed as an implementation of the contingent strategy, concentrates on the provision of different qualities of help intervention. Ecolab combines a structured environment of variable complexity and multiple viewpoints with the provision of specific instances of help.

3 The Zone of Collaboration

The specification of assistance is complex; the scaffolding process introduced by Wood et al [9] has its roots within Vygotskian theory and provides an illustration of a successful interpretation. The Ecolab design framework reconsiders this theoretical foundation and investigates what more can be gained from the Zone of Proximal Development concept. Two additional constructs: the Zone of Available Assistance (ZAA) and the Zone of Proximal Adjustment (ZPA) are used in an attempt to clarify the interpretation of the ZPD which is being used within the Ecolab. The ZAA describes the variety of qualities and quantities of assistance which need to be available to enable the more able partner (whether human or computer) to offer appropriate assistance to the target user group. The assistance which is selected and actually offered to the child needs to be matched to that particular child's ZPD. This is where the Zone of Proximal Adjustment [6] comes into play. The ZPA represents a selection from the ZAA appropriate for the given educational situation. Clearly, if the