Modelling and Supporting Learning Activities in a Computer-integrated Classroom

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ABSTRACT

We have implemented ubiquitous computing technology in a primary school setting to support rich classroom activities particularly in the field of early literacy. After initial tests have corroborated the benefit of this technology with respect to attaining curricular goals and to better supporting learner-centred classroom methodologies, we are now exploring specific intelligent support mechanisms, e.g., to inform participants - both teachers and pupils - about automatically assessed learning opportunities.

Keywords

Early learning, literacy, intelligent support, collaborative learning analysis, ubiquitous computing

INTRODUCTION

Computer supported collaborative learning is often identified with “virtual learning” in distance scenarios. In contrast to this, we have pursued the idea of enriching face-to-face classroom situations with embedded computing technologies. The technological approach was deliberately subordinated to grown curricular goals and pedagogical traditions. Recently, we have been able to demonstrate the benefits of such “computer integrated classrooms” in a specific learning domain (Tewissen et al., 2001). In this paper, we elaborate how specific forms of online support can be generated in computerised classroom environments. The classroom as such is a collaborative scenario with different roles (e.g., teachers, learners, peer helpers) and resources (network, archives, software tools, physical devices). In our view, automatic support functions are not meant to guide and control classroom learning processes globally but to locally enrich the situation, e.g., by informing participants about learning opportunities and affordances.

Within the European NIMIS project (“Networked Interactive Media in Schools”, cf. NIMIS, 1998), computer integrated classrooms have been set up in associated primary schools. Both hardware selection and software design have been orientated towards the special needs of early learners. The classroom design was based on principles of “ubiquitous computing” (Weiser, 1991) (Fig. 1). To give the pupils easy access to our computing facilities a special JAVA based software has been developed which replaces the Windows desktop. As a standard mode the desktop supports partner work by allowing two children to be logged in at a time at one workplace.

Fig. 1 The NIMIS classroom in Duisburg

The concept of a “computer integrated classroom” (CiC) is essentially targeted at fostering collaboration between pupils. In Duisburg, the focus was set on the process of learning how to read and write. Adapting a new method called “Lesen durch Schreiben” (Engl.: Reading Through Writing, RTW) which was originally introduced in Switzerland (Reichen, 1991) the application T^3 (“Today’s Talking Typewriter”) has been developed. It is a phonetics based approach for teaching reading and writing. Pupils get access to the complete range of phonemes in the form of a palette with letters from the very beginning. Thus children are able to write words by combining letters from a “phoneme table”, even though they are not yet able to read. In abstract terms RTW inverts the usual sequencing of the analytic task of de-coding (reading) and synthetic task of encoding (writing). T^3 is designed for usage with pen based interactive screens and behaves similar to the known procedure with pencil and paper in the normal classroom. (Fig. 2, cf. Tewissen et al., 2000).

INTELLIGENT SUPPORT

T^3 is enhanced to provide two different kinds of intelligent support, using the *Support Agent Architecture* developed by Prada et al. (2000). It facilitates intelligent agents which are not explicitly visualised but functionally embedded in the T^3 workspace.

Fig. 2 Phonetic writing with T^3

Phonetic diagnosis

To provide automatic support for the children's' phonetic writing it is important that target words are known by the system. (In phonetic writing, it is practically impossible to infer a target word from only two or three starting letters.) If a target word is known, a phonetic diagnosis can be performed by comparison which allows for sophisticated forms of intelligent feedback. T^3 provides a pre-selection of target words on so called "theme pages". The phonetic comparison between the target word and the writing product of the child is done by an algorithm that is based on a phonetic classification. It detects incorrect substitutions, missing and "wrong" phonemes.

Writing Support

There are two different intelligent agents in T^3. Both use the phonetic diagnostic algorithm. The first agent provides an embedded, "implicit" feedback during the writing process. Depending on the learning phase, the writing agent will first only analyse phonemes which are clearly pronounced and later also those which are not emphasised. The agent gives hints by "moving" the letters in the workspace to form a gap at the position where a phoneme is missing.

The second kind of support offers a selection of "peer experts" to those children who have problems detecting correct phonemes in a target word. The phonetic diagnosis determines the correctness values from the content of the workspace. If the score of the writing result exceeds a predefined limit the information is stored in a database. From this database, peer helpers will be selected according to their specific strengths. The mediation of peer helper is based on the methodology of "multiple student modelling" (Hoppe, 1995). The offer of peer helpers stimulates collaboration, which can take place outside the system in the classroom (by natural face-to-face communication) as well as inside the system in a special collaborative mode of T^3.

PERSPECTIVES

The intelligent support will be evaluated and improved in close cooperation with teachers. The indicators for the different stages of writing skills will be tested and checked against the teachers' expectations and observations in the classroom. A specific challenge lies in determining the point in time when learners start to read. This is particularly difficult since the overt actions in the system are only writing actions.

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