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Internet-based learning environment for project-enhanced science learning

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Project-enhanced work has been assumed to provide students opportunities for context-based "cognitive apprenticeships" in authentic scientific inquiry, using computers for data-collection, analysis and communication. Student teams are supposed to work collaboratively on often long-term projects with teacher guidance to develop their understanding of concepts and skills e.g. through problem solving and reflection. Through the use of technology, educators now have got new opportunities of transforming learning to better resemble the authentic practice of science. There are attempts to build network-based systems for participants by providing a supporting structure for project-enhanced science learning (O'Neill & Gomez, 1994; Pea, 1993). These tools usually allow shared inquiry, communication and knowledge-building together with project members through shared workspaces. However, we often assume that project-enhanced learning is automatically a good thing leading to deeper level learning, and only seldom describe the barriers for the promotion of successful learning. The aim of this study is to examine the possibilities and constraints of project-based work in networked science learning environment.

The subjects of the study were two classes of primary school students and their teachers participating in a science learning project. One pair of 10-11 years old girls (N=2) was chosen for detailed analysis and case description in this pilot phase of the project. The goal of the learning project was to gather, analyse and share ideas related to properties and recycling of plastics. The project lasted for three months, and the time spent on the project varied between three and eight hours per week. A particular pedagogical model was designed to support both individual and socially shared reflective thinking as well as reification of previously completed work (Lehrer *et al*, 1994). The model focused on planning, problem framing and monitoring, and it was integrated into the use of collaborative discussion environment called HyperNews. In this environment students could communicate with other students, teachers and experts by posting messages that could be labeled and linked to other messages. The HyperNews environment was used particularly in the planning and evaluation phases of the project work.

The results of the case study indicate that although spontaneous reflection was rather common in the face-to-face situations of the Plastics project, it was rather rare in the network discussions in the HyperNews environment. In general, the network discussions were descriptive rather than explorative and reflective in its nature. It seemed that stronger support, such as cognitive scaffolds and mentoring towards reflection, would have been needed. However, some crucial episodes including reflective discussion occurred during the projects. Typical for these episodes was that the teacher supported the students towards more reflective knowledge articulation activities and externalizing their own thinking especially during planning and evaluation phases of the learning project. Furthermore, by making

working processes explicit, the asynchronous discussion environment provided the teacher a possibility to follow working from phase to phase in order to assess in an adequate way, how to scaffold learning processes.

Based on these initial results of the project, it seems evident that project-enhanced learning sets new demands on students and teachers by challenging the traditional practices and support structures of schools. Learning from doing complex, challenging and authentic projects requires resourcefulness and planning by the student, new forms of knowledge representation in school, expanded mechanisms for collaboration and communication, and support for reflection and authentic assessment (Laffey *et al*, 1998). It can be argued that although research results have demonstrated computers to play a central role in re-structuring social interaction and knowledge construction, the realization of this potential is still not so self-evident in our institutionalized schooling (e.g. Pea, 1993; Scardamalia & Bereiter, 1994). As Windschitl (1998) has stated in Educational Researcher, on a way realizing this potential*"we need to understand better the relationship between technology, pedagogy, project-oriented curricula and student learning" (p. 28).*

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