

INTERMEDIA, UNIVERSITETET I OSLO

Meaning making trajectories across contexts of learning

Bridging the school and the museum

Supervisor: Dr. Ingeborg Krange

PhD Candidate: Alfredo Jornet Gil

Context

My PhD project is framed within the MIRACLE project, owned by InterMedia (University of Oslo). MIRACLE stands for Mixed Reality across Contexts of Learning. MIRACLE'S objective is to design an educational mission in which two different learning settings, the school and the museum, become bridged by a number of tasks and activities, and a set of tools and digital representations that together constitute a mixed reality learning environment. The ultimate goal of the mission is to optimally mediate conceptual, meaningful understanding of curriculum-related issues about science. MIRACLE will take advantage of a museum exhibition about energy that will be hosted by the Norwegian Science & Technology Museum (NSTM, Oslo) in 2013. In addition to the InterMedia research centre, the project counts with the participation of the NSTM, a Norwegian leading animation company (Storm Studios), a Swedish architecture studio (CoDesign), and educators from several high-schools in Oslo.

Background

One of the main goals of current educational standards is to facilitate *deep conceptual learning* (Sawyer, 2006), understood as a learning that transcends the mere acquisition of facts and procedures promoted by traditional *instructionism* (Papert, 1993). However, a recurrent finding in the literature on science learning is that students have difficulties in achieving understanding of standard meanings of scientific concepts (Osborne & Dillon, 2008; Roschelle, 1992), and that reproductive, more procedural oriented task are better mastered compared to those involving theoretical thinking (Giest, 2008; Ingeborg Krangle & Ludvigsen, 2008). One of the properties frequently attributed to conceptual understanding is its potentiality for transfer of knowledge within and across settings (Bransford & Schwartz, 1999). The assumption is that understanding a conceptual system that constitutes a knowledge domain provides learners with the skills required for solving any task or problem inscribed within the same knowledge domain. In this sense, deep conceptual understanding has been also related to lifelong learning (Scardamalia & Bereiter, 2006), a further goal of current educational standards.

At the core of the question of transfer lays (Greeno, 1997; Lave, 1988; Sawyer & Greeno, 2009), which postulates that learning does not occur as an isolated phenomenon within the learner's heads, but it emerges in interactive activity systems that are embedded in socio-cultural contexts. The relations between knowledge and the situations within which it

develops are central for understanding learning. Current conceptions of learning and schooling have been very much influenced by works framed within situative and socio-cultural perspectives, such as that of Brown, Collins and colleagues on *cognitive apprenticeship* (Brown, Collins, & Duguid, 1989; Collins, Brown, & Newman, 1989) or that of Lave & Wenger (1991) on *legitimate peripheral participation*. From those works, an appeal for educational practices more connected to meaningful, real-world problems can be read.

The range of learning settings that educators today consider as possible scenarios for their practices has broadened beyond traditional conceptions of education. Schooling is not necessarily restricted to the classroom anymore and the advantage of including out-of-school activities in their programs is acknowledged, as these are assumed to increase the social and material resources available for learning, providing closer models of real-world problems. However, the extent to which these out-of-school activities can have a positive impact on deep conceptual understanding is an active object of study in the literature. Among all typical out-of-school activities, science museums stand out as a resource for education on science subjects. Science museum's exhibits offer a number of unique characteristics that seem in principle suitable for learning, such as interactivity and a wide range of representational means (Allen, 2004). Learning in museums is indeed an active field of research (Falk & Storksdieck, 2005; Rennie & Johnston, 2004). Nevertheless, research explicitly addressing how an educational program develops across the school and the museum is more scarce (although there exist works dealing with the topic, such as Anderson, Lucas, Ginns, & Dierking, 2000; DeWitt & Osborne, 2007; Lucas, 2000), and accounts of how conceptual learning emerges and evolves across different settings are relevant for informing current educational practices (Steier & Pierroux, (in press))

Objectives and Research Questions

The overall objective of this PhD project is to explore how meaning making trajectories of high school students unfold across an educational mission on science that bridges the school and the museum settings. The project poses the following main research question: "Under what situations does student's meaning making discourses generate evidence of deep conceptual understanding along an educational mission that bridges the school and the museum?" By focusing on two different levels of description, two related sub-questions can be formulated: "How do the embedded representations and artifacts constrain

and afford the student's meaning making discourses?" and "How knowledge domain constrains and affords the student's meaning making discourses along an educational mission that bridges the school and the museum?"

Theoretical approach and Methods

The school and the museum represent two different institutional settings, with different and overlapping social and cultural purposes and histories that imply different meanings inscribed within. Different settings are assumed to mediate learning differently (Jahreie & Krange, In press; Scribner & Cole, 1973). In order to study how meaning and understanding emerges and develop across settings, a socio-cultural approach is adopted (Vygotsky, 1978; Wertsch, 1991), as it permits including historico-cultural aspects into the study of the socio-cognitive processes involved in learning scientific concepts. Consequently, mediated interaction within activity systems becomes the unit of analysis (Greeno, 2006; Roth & Lee, 2007; Wertsch, 1991). Language, the knowledge domain and the tools and resources found within the educational mission are considered as mediating the learners' shared conceptual understandings (Ingeborg Krange, 2007) in dialogical interaction (Marková, 1994). In analyzing discourse evolution towards conceptual understanding, Anne Sfards conceptualization of meaning making discourses is adopted. Sfards' considers higher-order (more abstract) discourses as subsuming prior (less abstract) forms of discourse that ultimately originated in action, through a process of expansion and compression (Sfard, 2008). Special attention is paid to the different digital and analogical representations of science, as they are embedded across the school and the museum. A design experiment methodology is suggested (I. Krange & Ludvigsen, 2009) as a mean for testing MIRACLE's different versions and releases in an iterative, continuous improvement through dialectic between theory, informal observations and engagement of stakeholders. Assessments would be run through interaction analysis, using video- and voice-recordings, as well as digital logs of interaction with and within the tools. In addition, semi-structured interviews and focus groups with the participants (students and tutors) will be further source of data. Interaction analysis is time-consuming, and MIRACLE will be source of a huge amount of data. In this sense, an approach that could be considered is that suggested by Creswell (2003), by which a quantitative method (e.g. coding and counting of interaction categories) could be used in order to locate fragments of data that could be further analyzed qualitatively (i.e. through interaction analysis), depending on what the focus of inquiry is.

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