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Budding Science and Literacy. A Classroom Video Study of the Challenges and Support in an Integrated Inquiry and Literacy Teaching Model

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Abstract

In the Budding Science and Literacy project, we explored how working with an integrated inquiry-based science and literacy approach may challenge and support the teaching and learning of science at the classroom level. By studying the inter-relationship between multiple learning modalities and phases of inquiry, we wished to illuminate possible dynamics between science inquiry and literacy in an integrated science approach. Six teachers and their students were recruited from a professional development course for the current classroom study. The teachers were to try out the Budding Science teaching model. This paper presents an overall video analysis of our material demonstrating variations and patterns of inquiry-based science and literacy activities. Our analysis revealed that multiple learning modalities (read it, write it, do it, and talk it) are used in the integrated approach; oral activities dominate. The inquiry phases shifted throughout the students' investigations, but the consolidating phases of discussion and communication were given less space. The data phase of inquiry seems essential as a driving force for engaging in science learning in consolidating situations. The multiple learning modalities were integrated in all inquiry phases, but to a greater extent in preparation and data. Our results indicate that literacy activities embedded in science inquiry provide support for teaching and learning science; however, the greatest challenge for teachers is to find the time and courage to exploit the discussion and communication phases to consolidate the students' conceptual learning.

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Keywords: inquiry-based science; literacy; video analysis; multiple learning modalities

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1. Introduction and background

In the latest Norwegian curriculum reform both inquiry-based activities and basic skills has been emphasized in science. In that connection, teachers have expressed needs for supporting teaching material. We have therefore developed a teaching model; the *Budding Science and Literacy* model (Ødegaard, Frøyland & Mork, 2009), inspired by the *Seeds of Science Roots of Reading* teaching program (Barber et al. 2007) and adapted to the Norwegian context. Through a professional development course teachers were to try out and adapt units of the *Seeds of Science Roots of Reading* curriculum material in their Norwegian science classrooms with help from science education scholars. The teachers and their students found the material to be engaging and meaningful to work with. Based on the teachers' reflections and our video observations from their classrooms, the *Budding Science and Literacy* teaching model was further developed. Norwegian teaching material that integrates inquiry-based science and literacy will eventually be available for science teachers.

Large scale studies show that integrated inquiry-based science and literacy activities give increased learning outcomes (Wang, 2005; Cervetti, et al. 2012). Our research contribution, however, is based on small scale, in-depth video studies, where teachers and students are followed closely in their classroom. The main purpose of this study is to explore how an integrated science and literacy approach may challenge and support the teaching and learning of science at the classroom level. By studying the interrelationship between multiple learning modalities and phases of inquiry, we wish to illuminate possible dynamics between science inquiry and literacy in an integrated science approach. The video analysis in this study is guided by the following research questions.

- How do multiple learning modalities vary during an integrated science approach?
- How are different phases of inquiry distributed throughout an integrated science-literacy approach?
- How are multiple learning modalities and the use of key concepts included in different inquiry phases?

2. Theoretical background

Literacy and scientific inquiry are important elements of science education. They both have a twofold role of being activities that afford support structures for learning science content and understanding scientific concepts, but also literacy and inquiry activities in themselves are important content knowledge of the science curriculum (Wellington & Osborne, 2001; Norris & Phillips, 2003; Knain and Kolstø, 2011) . David Pearson and colleagues (2010) claim that literacy and science are each in the service of the other, and that a curriculum based on the two, will give synergy effects. Science learning benefits from embedded literacy activities, as literacy learning benefits from being embedded within science inquiry.

Video analysis enables us to analyze and compare different layers of activities and search for patterns (Ødegaard & Klette, 2012). We explore how working with an inquiry approach together with literacy activities in science classrooms, influence each other. By doing video analyses of classroom activities we are able to get an overview of the variation and succession in the afforded inquiry and literacy activities. This video analysis forms the basis for further in-depth studies in the Budding Science and Literacy project (Ødegaard, Frøyland & Mork, 2009).

3. Design

We have studied 6 teachers from 4 schools and their students, during a sequence of science lessons. (5-10 lessons per teacher) The students range from 1st to 5th grade. The teachers all used adapted versions of Seeds and Roots units (Barber et al. 2007) as curriculum material. Each lesson was videotaped.

We developed a coding scheme for multiple learning modalities and inquiry activities (see table 1). The analyses were done with Interact coding software[†]. For the overview coding we coded the occurrence and duration of each

[†] http://www.mangold-international.com/software/interact/what-is-interact.html