

INQUIRY BASED SCIENCE AND MATHEMATIC TEACHING OUTSIDE THE CLASSROOM, PUPILS CHOICES AND LEARNING OPTIONS

One fifth of all Danish schools have one or more classes being taught curriculum based outdoors regularly, e.g. one day every week or every second week. This concept is known in the Scandinavian countries as udeskole (DK) and uteskole (N). Teaching outdoors has been showed to impact pupils learning, motivation and subject related knowledge and is being discussed as pupil activating, problem oriented and child centred. In this study, the occurrence of inquiry based teaching in science and mathematics in udeskole, is assessed. To analyse practice, we extended the notion of inquiry based education, i.e. IBSME, by broadening the concept of inquiry, in order to include a more non-linear teaching approach. Using this idea, we studied how five experienced teachers practiced mathematics and science teaching in Danish udeskole at lower secondary level. Our analysis of 28 observation days and 5 interviews indicates, that udeskole has the potential to support an explorative inquiry-based teaching in a broad sense in mathematics and science. Furthermore, our studies point towards that some outdoor mathematics and science teaching practice seems to emphasise pupils choice, and by this could have the potential to strengthen pupils diverse approach to inquiry

Keywords: Inquiry-based teaching, Outdoor Education, Teaching Practices

INTRODUCTION

Teaching outside the classroom has been discussed as a powerful way to teach curricular content (Rickinson et al., 2004; Becker et al., 2017). Outcome assessment highlights how changing the place of teaching can support the long-term nature of pupils learning, implying that educational experiences should not only be assessed by the pupils' ability to give correct answers right afterward a teaching sequence, but should take into account long-lasting learning outcomes.

Outdoor education can imply open-ended, problem solving tasks, involving inquiry-based educational approaches where pupils are offered an element of free choice (Braund, 2004). Inquiry is widely used in science education, and the discussion concerning the conceptualising of inquiry is ongoing (Artigue and Blomhøj, 2013; Pedaste et al., 2015). A common understanding of inquiry in science and mathematics education called IBSME (Inquiry-based Science and Mathematics Education) is connected to step-wise processes, ordered in distinct phases (Pedaste et al., 2015; Bybee et al., 2006). Developing a problem-based culture, allowing various ways to solve problems, the first key feature of inquiry in the Fibonacci project (Artigue et al., 2012) emphasising the ability to solve unknown problems by thinking and reacting autonomously. In our understanding of inquiry, experience and sensory perceptions can be key elements in an 'orientation' phase. Inquiry-based teaching is then both a method to learn a certain content, and an approach, recognising the tentative and social part of science and mathematics (van Uum et al., 2016).

The concept of ‘free choice learning’ recognises characteristics of learning as non-sequential, self-paced and voluntary (Falk, 2005). Bamberger and Tal (2007) identified the constituents of choice the pupils met at science museum visits. From the guided tour with no choices, to levels of limited choice with choices regarding topic, space, objects, time, order, collaborators and kind of interactions. In the other end is the free exploration of the exhibition. In inquiry-based teaching, the pupil makes a choice of method (Bromley et al., 2013) based on reflection on the consequences.

The second key feature of inquiry-based science education (Furtak et al., 2012) is the degree of guidance, described as a continuum between the highly teacher-driven and the pupil-oriented teaching activities.

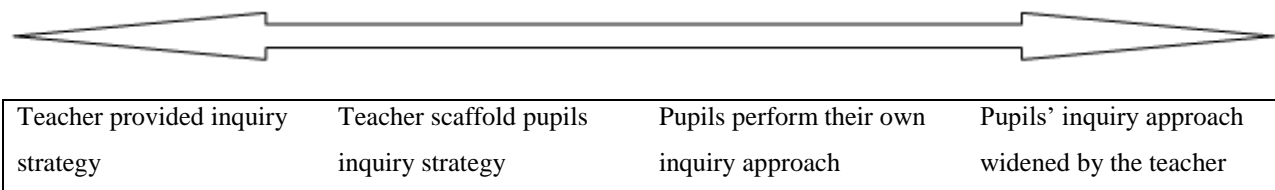


Figure 1. Continuum of guidance in inquiry-based teaching. Inspired by Furtak et al. (2012), p. 306.

Teacher actions supporting inquiry-based learning in practice (Harlen, 2004) are thus important.

METHODS

To get in-depth insight into individual teachers' intentions and practice in teaching udeskole, a qualitative case study method was chosen. Five educated teachers were studied by participating observation during a school year. Twenty-eight days with naturally occurring udeskole lessons were observed, and seventy-one teaching incidents outside the classroom was analysed in relation to free choice and inquiry-based teaching.

RESULTS

We found three categories of teaching supporting pupils inquiry in udeskole, and their choice options in the inquiry process. The three categories are a) when the teacher scaffold pupils during the inquiry, b) when the teacher does not interfere with the pupils performance during the inquiry, and finally c) when the teacher widen the pupils inquiry approach.

Analysed on this basis, our results show how half of the observed teaching incidents outdoors in mathematics and science can be regarded as inquiry based.

DISCUSSION AND CONCLUSION

Teaching outdoors seems to have a potential in developing an inquiry based culture in science and mathematics education. Some of the recognised effects on pupils being taught outdoors can possible be related to the more open-ended approach to tasks given by the teacher. Thus, by this study we get a small

step closer to understand some parts of the underlying mechanisms forming the basis for the outdoor teaching consequences. Further studies on larger samples could shed light on these possibilities.

Disclaimer: Our results has been published.

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