An integrated approach to inquiry based science learning in a secondary school: designing a colony on Mars

AN INTEGRATED APPROACH TO INQUIRY BASED SCIENCE LEARNING IN A SECONDARY SCHOOL: DESIGNING A COLONY ON MARS

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Abstract

This paper describes the learning design and the first phase evaluation results of a pilot with a technology-enhanced inquiry based approach (weSPOT) to Science learning in a secondary school. By piloting this learning design, the school strives to increase students' motivation for the Science-domain, in combination with developing several 21st century skills and applying domain knowledge to real world problems. This paper reports the first experiences with and effects on motivation of the pilot.

Keywords: Inquiry based learning, STEM education, 21st century skills, cyclic (agile) development, technology-enhanced education, educational design, motivation

1 INTRODUCTION

Societal and technological changes have also led to changes in the perception of educational objectives for primary and secondary schools. In the not so far away past, stress was predominantly on achieving knowledge (of the world surrounding students, e.g. about traffic rules) and basic skills, such as language and mathematical skills. This knowledge and skills, defined in curriculum objective plans, were seen as the main targets, and although other complex skills, such as collaboration, problem solving and digital literacy, were sometimes seen as a means to achieve them, they were not seen as objectives themselves. However, increasing awareness of the fast pace in which the world around us changes, have let to more stress on skills which are seen as instrumental to cope with these changes, and which are therefore increasingly seen as learning objectives themselves. These skills, enclosing critical thinking, creativity, problem-solving, communication, collaboration, digital literacy, social and cultural skills and self-regulation, are called '21st century skills [1, 2, 11, 12].

The importance of the so called 21st century skills is recognized by both policy makers as well as by teachers and school managers, and frameworks with these skills are defined at national and international policy levels [1][2]. However, implementation of 21st century skills at school or classroom level is seldom, as a link to approaches to implement them is currently missing [12]. Few countries have developed implementation plans and assessment policies for these skills. While teachers in primary and secondary schools may want to introduce learning activities supporting the achievement of these skills' in their class, they are struggling with how to do so. Teachers experience a lack of practical, implementable educational models and instruments, ICT-tools or guidelines for implementing learning activities and assessment practices. Furthermore, teachers experience this lack of educational methods as a drawback, while they are still actively searching for good practices, tools and instruments that they could use [3].

In this paper we describe one 'translation' of 21st century skills-objectives into an educational scenario that is implemented and evaluated in practice. We report about the design, implementation and evaluation results of the first phase of a pilot conducted within the context of the Science domain in a secondary school. In this pilot domain knowledge acquisition, application of this knowledge to real world problems and developing 21st century skills were integrated, based on a technology-enhanced inquiry approach to science learning.

We were interested in whether this alternative learning design would impact the motivation of students and also whether it would impact the acquisition of domain knowledge. However, in this paper the focus is on perceived task value and motivation of students. In the first section we describe the background, objectives and learning design of this pilot, compared to the maintained set of learning activities for Science classes as they were implemented before. Then we describe the evaluation methodology, including the instruments used. We report the results of the evaluation of the first phase