LEARNING MATHEMATICS AND SCIENCES IN AN OUTDOOR ENVIRONMENT

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Abstract

In this study, we evaluate the effectiveness of an outdoor education programme, in which 10 and 11 year old pupils visit during ten weeks a farm, a garden or a forest. The farmer and the teacher teach several subjects in this authentic environment and get the pupils the opportunity to perform authentic tasks. Both quantitative and qualitative data is gathered. Pre- and posttest measurements are taken of the pupils concerning motivation, self-concept, and academic performance on mathematics. Each project is also visited twice by an extern person, in order to get an overview of the obstacles that are encountered in practice.

Keywords: outdoor education, mathematics, sciences, STEM.

1 INTRODUCTION

In order to create meaningful learning situations, authentic experiences are very important for pupils [1]. Cognition and situations should not be interdependent [2], but knowledge should be a tool to solve real-life problems. The theory of 'situated learning' dates back to 1988, where Collins defined it as "the notion of learning knowledge and skills in contexts that reflects the way the knowledge will be useful in real life" (p. 2) [3]. The main characteristics of situated learning are: providing an authentic context and authentic activities, access to expert performances, providing multiple roles and perspectives, collaborative construction of knowledge, promoting reflection and articulation, coaching and scaffolding, and providing authentic assessment of learning [2]. Situated learning is recently also called authentic learning. The characteristics of authentic learning are similar. Rule [4] studied 45 journal articles about authentic learning and concluded that authentic learning involves problems rooted in the real world, it addresses open-ended inquiry, thinking skills and metacognition, it compromises social learning in a community of learners, and learners are empowered through choice to direct their own learning. Interlaced with an authentic environment are authentic tasks, which are tasks that resemble to real-life tasks and requires a variety of knowledge and skills to be solved [5].

In this study, the outdoor environment will be the authentic learning context. Children play less outdoors nowadays compared with the past, and the adult supervision is increased [6]. There are several studies investigating the impact of one outdoor excursion on motivation, attitudes and performances (e.g. [7], [8]). It seems like one-day field trip might have a short-term effect on students' attitude and knowledge [7]. However, there are only a limited number of studies in which this outdoor activity is repeated several times, is part of ordinary school work, and is systematically incorporated in the lessons.

There are also multiple studies in which the outdoor environment is brought to the school, in so called garden-based projects. Here, a garden at the school is used as a teaching tool. In a meta-analysis [9], it was found that school-gardens have a positive impact on academic outcomes, especially for sciences, but the school garden also had a positive impact on social development. However, it cannot be expected that all schools have the space and utilities to create such a garden at school. Therefore, in this study, the focus will be on repeated field trips to a farm, garden or forest. In this way, we hope to combine the best of field trips and garden-based learning. Therefore, we are interested in the effect of this type of programme on academic achievement and non-academic outcomes. We also focus on the difficulties encountered during such a programme.
2 METHODOLOGY

This study is part of an outdoor teaching intervention project in Flanders, Belgium. In this project 10 and 11-year-old pupils have every week mathematics and sciences classes in an outdoor environment, such as a farm, a garden or a forest, and this during 10 weeks. There are 15 classes taking part in this project. The owner of the farm, garden or forest is the host, and teaches to half of the class. In the meanwhile, the usual teacher teaches to the other half of the class. After 50 minutes, the two groups of pupils switch. Each session start with a theoretical introduction of 15 minutes, after that, the pupils get chores and authentic tasks related to the subject just taught. The subjects are tackled, making use of the authentic context of the farm, garden or forest were the activity takes place.

In this study, we evaluate this project in two ways. First, a quantitative study is performed, in which the motivation, self-concept, academic performance on mathematics of pupils is measured, before they start with the project, and once the project is finished. Pre- and posttest results will be compared using a repeated measures ANOVA. The questionnaire is based on previous research in Flanders, more in particular SIBO, a longitudinal research in primary education [10].

Second, every location is also visited twice by an extern person, and evaluated with an observation tool. Also other written documents (like e-mails about the progress of the project) were gathered. This information is analyzed in a qualitative way. With this data, we want to obtain an overview of the obstacles that are encountered in practice. But also how it comes that some projects evolve very well and others do not.

3 RESULTS

In this stage, we only have the result of the pre-test of the survey. By the end of June, also the posttest results will be available and will be analyzed.

During this first half of the project, we already encountered some obstacles. Therefore, only some preliminary results will be reported.

Observation 1: Both the host and the teacher are the key persons in this project.

There are a total of 15 classes taking part in this project. The classes were problems occur, are often also the classes where the teacher is less motivated. The teachers are often uncomfortable, because they have to teach in a context that is unfamiliar for them, and the learning content is also often new for them. After the first year, one school dropped out of the project, as the teachers did not do the necessary efforts. Of course, the majority of the teachers were highly motivated, and interested in the outdoor environment.

Most of the hosts participating in this project also have a teacher’s degree. For one farmer, this was not the case, and in this situation, problems occurred because the farmer was not used to deal with children of this age group. He had troubles with teaching the theoretical parts, and did not how to reprimand the children in an appropriate way.

Observation 2: Communication enhances the project

The classes were there is a lot of communication between the teacher and the host, are also the classes were the project evolves very well. Some hosts or teacher send every week an e-mail to each other with the plans for next session.

Observation 3: There is often a lack of time for the chores and hands-on activities.

Every session is supposed to start with a more theoretical introduction. This should take only 15 minutes, but in the observations, it is seen that this often takes more than half an hour. There are several possible reasons for this. Sometimes the host want to share a lot of its knowledge, and the pupils asks a lot of questions. But sometimes, teachers are also afraid to give the pupils the liberty to work on their own.

Observation 4: This project requires a lot of effort

During this first year, the project is subsidized by the province of West-Flanders, Belgium. With this money, lessons are created and a lot of support is given in providing the necessary materials and drawing up the plans. These extra support is more than necessary, but is also temporary. It is unclear how the project will evolve without this additional support. However, the schools pays the hosts of the
outdoor education some money for the project, but this is not enough compared with the amount of work that is asked of the hosts during the first year.

4 CONCLUSIONS

This project, in which pupils go repeatedly to a farm, garden or forest, has just started, and still a lot of exploratory work has to be performed. We do not yet have the results of academic and non-academic performances, but based on previous research, we expect these to be positive. The authentic context of an outdoor location will probably have a positive influence on the motivation of children, and this motivation may have a positive influence on the academic performances.

However, based on the qualitative data, we encountered several obstacles that still have to be solved. This project requires a lot of effort, both of the hosts of the outdoor locations, and the teachers. One of the classes will even not return next year to the farm due to amount of work this project asks for. There is also a teacher appointed with grants in order to create learning materials for the outdoor educations. However, this grant is only temporary, and it is unclear how this project will evolve in the future.

On the other hand, most groups do have positive experiences with the project, and will continue doing this the following years. The continuity of the projects undertaken is assured in this way.

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REFERENCES