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Exploring affective reactions of children to Scratch programming and mathematics: The case of Kim

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Background

Around four decades ago the use of programming as a medium for mathematical learning became the focus of research for some mathematics educators (Papert, 1980; Noss and Hoyles, 1992). The new computing curriculum in the UK with a strong focus on programming inspired the ScratchMaths project which rescues this idea and aims to exploit the potential of programming in Scratch to support mathematical thinking (Benton et al., 2016). Using this project's designed materials the purpose of my research has been to investigate the kind of affective reactions that emerge from the experience of Year 5 children working with the activities during their computing lessons. Given the connection of the materials with mathematics, and the relationship between mathematical and computational skills, those children that underperform in both subjects have been of particular interest for my study. Three Year 5 classes (sixty 9-10 years old in total) from a primary school in London and taught by the same teacher were observed for sixteen weeks during computing lessons. 11 children were purposively chosen to participate in the research.

Building mainly on the literature on affect and mathematics education (McLeod, 1992; Hannula, 2012) and based on results from the pilot study, three categories concerning efficacy beliefs and emotions were explored: perceived efficacy, general emotion and emotion enjoyment. The three main research questions were:

- What kind of experiences do participants have when working with the activities?
- What changes can be observed (positive/negative evolution of the learner's perspectives)?
- On what might a positive or negative evolution of the learner's perspective depend on?

Methodology

The research used a case study approach and combined different methods for data collection: questionnaires (a short questionnaire administered lesson by lesson during 12 weeks and the attitudes towards Scratch questionnaire), field notes, students' work and critical incident (CI) interviews. The short questionnaire allowed the researcher to capture systematic information along the three categories explored regarding different types of tasks. Indicators above 5 were considered positive reactions, below 5 were considered negative reactions, and equal to 5 were considered neutral. Key moments were identified and were then triangulated with data from other sources.

Results

Kim's responses to the short questionnaire (Figure 1, left) suggest that for her, positive affective reactions tended to happen when the activities were of an exploratory nature and negative reactions

when the activities had a more explicit mathematical focus (Figure 1, right). Nonetheless, she had positive or neutral experiences around 80% of the times that the questionnaire was applied.



Figure 1: On the left, graph of Kim's response to the short questionnaire. On the right, examples of a task with mathematical focus (lesson 5) and a more playful and exploratory task (lesson 6)

Data from the affect towards Scratch questionnaire administered in January and June of 2016 indicates that she had had a negative evolution of perspectives as a learner in this context. Data triangulation from all sources suggests that Kim had noticed a connection between the activities and mathematics and that this connection might have played a crucial role in her learning experience. Children who struggle with mathematics may be in disadvantage when tackling some of the ScratchMaths activities on their own in classroom conditions. In the case of Kim, the involvement of mathematical skills in the activities seemed to trigger negative affective reactions and the belief that she just could not do it. However, when extra material and individual support was given during the lesson she was able to solve the task, help other students in the class, and moreover, she regarded that particular lesson as her best moment working with the activities.

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