Use of storytelling to increase engagement and motivation in computing in lower primary schools

Authors: Saman Rizvi, Katharine Childs, Hayley Leonard, Oliver Quinlan and Jane Waite, Raspberry Pi Foundation, and Sue Sentance, Raspberry Pi Computing Education Research Centre, University of Cambridge

Rationale and related work

Recent work has shown that girls are much less likely than boys to aspire to careers in STEM [2]. Common barriers for girls studying CS include limited role models in the field, a lack of a sense of belonging, and issues of relevance of learning activities. To address some of these barriers, researchers have demonstrated how storytelling approaches are related to other school subjects and how they may be effective for young children. For instance, K-5 research has found close synergies between planning writing in literacy lessons and learning to design digital stories [6]. Whyte et al. [7] found that students aged 9-10 could effectively create digital stories using visual programming tools and that learners were motivated to pursue programming projects independently. In addition, planning and writing digital stories was found to increase the motivation of girls aged 11 to 15 to engage in programming [5]. Storytelling may be effective for engaging girls in computing, yet storytelling approaches have not been widely investigated for our youngest learners.

Our study and participants

This study investigated how storytelling could be used to engage girls and, more generally, K-2 pupils in computing. We defined storytelling as using narrative to teach computing through digital story-writing and digital storytelling. The study is part of a government-funded research programme comprising of five interventions that has been externally evaluated [4].

To ensure representative coverage, a third-party paid-for marketing campaign was used for recruitment. 60 schools were recruited and 1096 students participated. After data cleaning, data from 346 girls and 326 boys were included (see Figure 1).

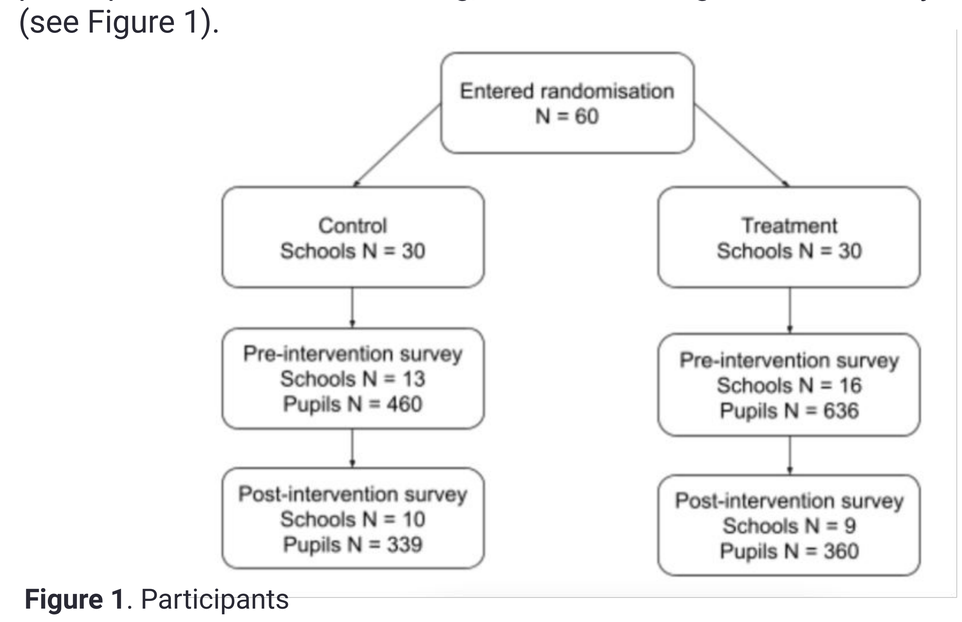

Figure 1. Participants

The treatment group teachers completed mandatory online training, structured into three self-directed sessions that included a rationale for the storytelling approach, ScratchJr training, and a walkthrough of lesson plans and resources.

Teaching materials

Quality assured resources were created for the study and used by classroom teachers to deliver 12 one-hour weekly lessons in April-July 2021 (see Figure 2). Teachers in the control group delivered their existing computing curriculum lessons over the same period.

Unit	Lesson	Title	Learning Objective
1	1	What's ScratchJr?	To program a character to move
	2	Once upon a time…	To identify links between a story and a computer program
	3	Repetition, repetition, repetition	To create a simple program using repetition
	4	Timing is everything	To control timing in a simple animation
	5	Two's company	To control two characters in a simple animation
	6	Let's get moving	To use a range of Motion blocks to control a character
2	1	Speech bubbles	To create two characters in conversation
	2	Messages	To create two characters who interact and 'speak' to each other
	3	I'm going to bump into you	To create physical interaction between characters
	4	I'm going to tap you	To create stories with user interaction
	5	Drawing ideas	To create a labelled drawing for a digital story
	6	Let me tell you a story	To program a digital story in ScratchJr

Figure 2. Lessons created for the study

Method

External evaluators created a pre- and post-survey based on The Computer Science Attitudes Survey [3]. Adapted for use with K-2 pupils, the survey investigated i) pupils' attitudes toward computing ii) intention to study computer programming iii) intention to study science and/or maths (see Figure 3).

Computing attitudes survey					
1	I think I am good at computer programming	☹	😐	☺	Don't want to say
2	I think it is easy to answer questions in computer programming	☹	😐	☺	Don't want to say
3	When I have to solve a problem in computer programming, I feel...	☹	😐	☺	Don't want to say
4	I like computer programming	☹	😐	☺	Don't want to say
5	When I write a computer program, I feel...	☹	😐	☺	Don't want to say
6	I wish I could do more computer programming lessons	☹	😐	☺	Don't want to say
7	In computing programming class, I feel...	☹	😐	☺	Don't want to say
8	Computer programming is for people like me	☹	😐	☺	Don't want to say
9	I get on with the people in my computer programming class	☹	😐	☺	Don't want to say
10	Knowing about computer programming will help me get a job	☹	😐	☺	Don't want to say

Figure 3. K-2 computing attitudes survey

The survey was reviewed by a specialist computing teacher, tested with pupils, validated by exploratory multiple-factor-analysis and administered in intervention and control schools. Survey data was analysed using linear and logistic regression.

Qualitative data was collected in three intervention schools. Lesson observations investigated pupil engagement, lesson fidelity, and barriers to lesson delivery. Teacher interviews focused on perceived impact of the intervention. Pupil discussions were also held with four girls and two boys. Qualitative data were analysed using the framework method from Gale et al. [1].

Results

Comparing pre-post survey results between intervention and control groups there was no statistically significant difference in changes in student' attitudes toward computing or in their stated intention to study computer programming or science and/or maths in future. However, for the intention to further study programming, a small negative treatment effect for boys was observed but this finding should be interpreted cautiously due to sample size and potential teacher influence on survey answers.

Teachers reported that storytelling generally impacted positively on girls' attitudes toward computing, particularly their enjoyment, confidence, and sense of belonging. Some teachers reported that lessons may have engaged pupils by allowing them to embed their own interests in their stories (e.g. choosing their own characters). They commented that pupils enjoyed being able to choose their own backgrounds and characters which aligns with findings with slightly older students [7].

> "[It] gives them something real to work through, so it's not. . . abstract. . . they're able to make it as funny or whatever they want, and it's also their own interest. [Female pupil name], she dotes on animals, so she's always having giraffes and all of that, so it's something that they can make their own connections too . . . I did really like the storytelling."

Conclusion and next steps

Despite limited attitudinal differences between intervention and control group survey data, the pilot evaluation revealed qualitative data that the intervention design was engaging for pupils and feasible for teachers. In future work, we suggest conducting a larger scale investigation of the storytelling intervention.

References

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