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

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ABSTRACT

Research suggests that gender-based stereotypes in computing may develop at an early age. However, there is limited evidence on how teaching interventions can be used to increase engagement and interest, especially in computing education for young pupils. We describe a small-scale intervention which is part of a larger programme addressing barriers to female students' uptake of computing. This study focused on pupils aged 5-7 (K-2) and the use of a storytelling approach to teach programming. It consisted of a 12-week pilot randomised control trial (RCT) in 19 schools in England (346 girls and 326 boys). Despite limited evidence of change in pupil attitudes when comparing intervention and control group survey data, qualitative evidence suggests the intervention was feasible for teachers and engaging for pupils. We conclude that the pilot has the potential to be built upon, scaled up and investigated further.

KEYWORDS

computing education, gender, K-12 education, storytelling, teaching

1 INTRODUCTION

Computing has a decades-old problem with gender imbalance. While girls tend to outperform boys in computer science (CS), they may be less encouraged to continue with or study CS in the first place. Some evidence suggests that a sense of belonging and strong role models can influence uptake and attitudes toward STEM fields [2] yet less on what approaches could be designed to address these issues. Against this background, a government-funded research programme was implemented which comprised five interventions. This poster shares lessons from one of these interventions that aimed to investigate how different teaching approaches could be used with K-2 children. We outline the design of this intervention and some preliminary findings from a third-party independent evaluation; the full evaluation was published separately in a technical report [4].

2 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 employing storytelling approaches has not been widely investigated for our youngest learners. Our current study was designed to investigate how storytelling could be used to engage girls, and in general, K-2 pupils in computing.

3 THE STUDY

The study piloted the teaching of programming to K-2 pupils using a storytelling approach. The study was run as a pilot RCT by one research group and evaluated by another. The authors of this poster created the resources and implemented the intervention. The primary research question was **"To what extent is there initial evidence that a storytelling teaching approach intervention has an effect on the general attitudes towards computing and future subject choice for K-2 children?"**. The resources created were i) Unit 1 (6 lessons) introduction to ScratchJr and the fundamental coding 'blocks' needed to write story-based programmes; ii) Unit 2 (6 lessons) introduction to more complex blocks needed to create a complete digital stories. Resources were quality assured, including review by an expert in the field. The 12 one-hour weekly lessons were delivered in April-July 2021 by classroom teachers.

The intervention group teachers completed mandatory online training, structured into three self-directed sessions that included a rationale for the storytelling approach, ScratchJr training, and a

walk-through of lesson plans and resources. The materials were provided to encourage teachers to employ storytelling into their lessons. Teachers in the control group delivered their existing computing curriculum lessons over the same period. Though the intervention was delivered to all pupils in mixed-gender classes, the primary focus was to improve the overall experiences of female pupils.

4 PARTICIPANTS AND EVALUATION

Schools were recruited through a third party paid-for marketing campaign to ensure representative coverage. 60 schools were initially recruited to the study and randomly allocated as either intervention or control. 9 intervention and 10 control schools completed all aspects of the intervention and evaluation. 1096 pupils participated in the study. 699 pupils completed the post-intervention survey, and after data cleaning, data from 346 girls and 326 boys were included.

To evaluate the intervention, external evaluators designed a pre and post survey to investigate i) pupils attitudes towards computing ii) their intention to study computer programming iii) the intention to study science and/or mathematics. The survey adapted the Computer Science Attitudes Survey [3] for use with K-2 pupils. The instrument was reviewed by a specialist computing teacher, tested with pupils, validated by exploratory multiple-factor-analysis and administered in intervention and control schools. The survey data was analysed using linear and logistic regression.

Supplemental qualitative data was collected in three intervention schools (lesson observations, teacher semi-structured interviews, pupil discussions). 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] which identified a range of views and experiences.

5 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 [4].

With regard to qualitative data, teachers reported that storytelling generally impacted positively on girls' attitudes toward computing, particularly their enjoyment, confidence, and sense of belonging. They noted that the lessons improved pupils' computing skills and confidence. One teacher observed pupils "smiling and discussing their work with other students …they expressed disappointment and let out a big collective sigh when told that the lesson that day would be their final Storytelling lesson." [4, p. 26].

Storytelling also provided pupils with a concrete application of their skills:"[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." [4, p. 27].

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 to findings with slightly older students [7].

6 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 next steps, we suggest conducting a larger scale investigation of the storytelling intervention.

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