

SewSimple in Practice: Designing an E-Textile Tutorial for Primary Computing Education

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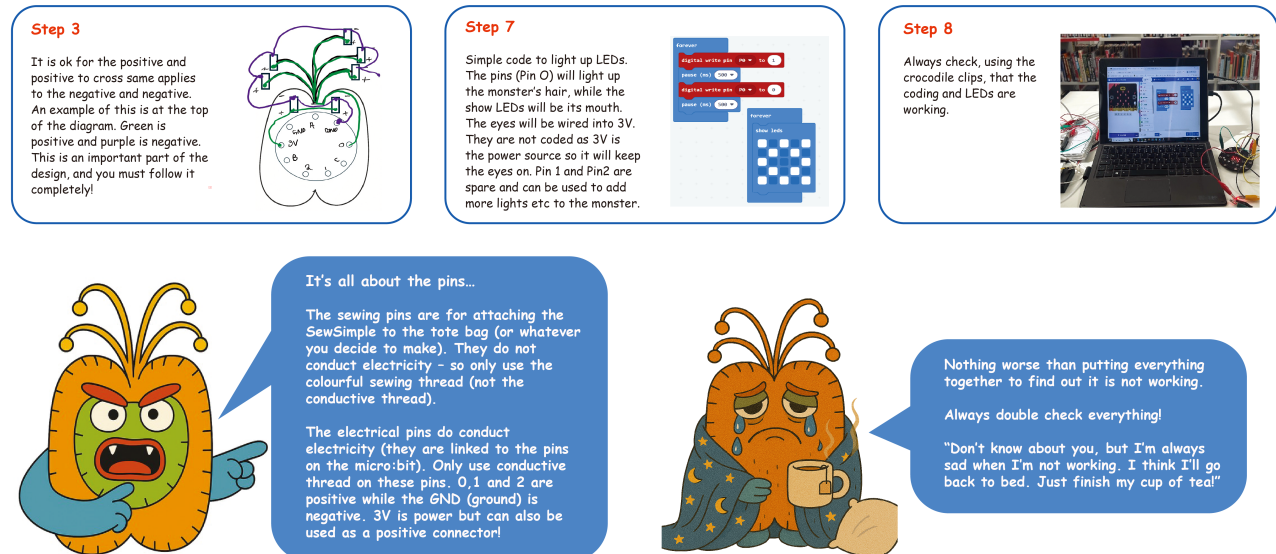


Figure 1: First Row: example tutorial steps for 1) Drawing the Circuit, 2) Writing Code, 3) Testing. Second Row: debugging guidance: 1) Explain pin types, 2) Explain why you test first.

Abstract

We present a tutorial for teaching e-textiles with BBC micro:bit and the "SewSimple" maker kit aimed at developing computational making skills. We approach instructional design by drawing on the authors' lived experiences as schoolteachers, computing education and HCI scholars, and learning technologists, while engaging with the English national curriculum through an interdisciplinary lens that integrates computing with art and design. This approach facilitates the development of creative and constructing skills essential to e-textile design, while enabling students to apply computing

knowledge to create functional artifacts. Our work shows how art and design can be effectively integrated with technical skill development. Furthermore, we demonstrate that "SewSimple" offers both usability and educational affordances necessary to support teaching objectives and achieve English computing curriculum goals.

CCS Concepts

• **Applied computing** → **Education**; • **Social and professional topics** → **Computing education**; • **Human-centered computing** → **Collaborative and social computing**; • **Hardware** → **Printed circuit boards**.

Keywords

Computational Making, Computing Education, E-textile, BBC micro:bit, Creativity

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1 Introduction

Maker education leverages the arts and constructivist learning to teach computational thinking skills [3, 9], and it has gained popularity in computing education [11]. Within this body of work, the computational making framework [13] highlights both the challenges of making practices and the educational potential of maker tools such as e-textiles for teaching young students five core values: *aesthetics, creativity, constructing, visualizing multiple representations, and understanding materials*. The “SewSimple” is an e-textile maker kit, serving as an edge connector for the BBC micro:bit to address the hardware challenges children face when using it for computational making with e-textiles [5, 12]. These hardware challenges were critical to learners’ experience, given the importance of e-textiles in encouraging gender-diverse participants in computing [2, 7, 8] and equity goals highlighted by the BBC micro:bit Educational Foundation [1]. Earlier research shows that it has potential to be integrated into the English National Curriculum [6], and yet teachers require significant curricular support. Here, we present the first comprehensive tutorial developed by a computing schoolteacher as a case study to address the pedagogical gap and learning opportunities with Key Stage 2 children (ages 7-11) in computing. This work aims to enhance the understanding of the usability and curriculum fit for introducing e-textiles using “SewSimple” within primary computing education.

2 The SewSimple Maker Kit

The “SewSimple (V1.1)” (see Fig. 2b) was created using a flexible circuit board (FCB) and water-resistant fabrics, measuring 84mm by 84mm with a thickness of less than 4 mm. With its flexibility, improved sewability, and safety considerations, it is an add-on electronic component to the BBC micro:bit, enhancing its utility and usability in e-textile crafting and supporting more body-centric creative applications, particularly in wearable fashion. It features two sets of grommets (plated through holes). The first set allows users to securely anchor the board to their garment, while the second set provides non-load bearing electrical connections that ensure the connections. The design significantly reduces sewing unstable connections commonly seen in e-textile activities [5].

3 Curriculum Objectives and Learning Design

The tutorial was designed based on the national curriculum guidance [4, 10] to support KS2 students in both computing and/or art and design subjects.

3.1 Tutorial Learning Objectives Highlights

3.1.1 Computing.

- Design, write, and debug programs that accomplish specific goals, including controlling or simulating physical systems; solve problems by decomposing them into smaller parts.
- Use sequence, selection, and repetition in programs; work with variables and various forms of input and output.
- Use software to create a range of programs that accomplish different goals.

3.1.2 Art and Design.

- Produce creative work, exploring ideas and recording experiences; Proficient in art, craft, and design techniques.
- Evaluate and analyze creative works using the language of art, craft, and design.

3.2 Tutorial: A Good Monstrous Totebag

The tutorial creates a tote bag adorned with a monster using a BBC micro:bit and the “SewSimple” kit (see Fig. 2a). The tutorial includes a supply list and step-by-step instructions to complete the project, including both the artistic and technical elements. From a craft standpoint, it teaches how to use paper patterns, embroidery hoops, and fabric pens. Technically, it focuses on teaching skills to design and layout a circuit, program event-based actions using MakeCode, and debug both hardware and software. The program is fairly straightforward and uses a loop and digital write commands (see Fig. 1). The debugging, however, is complex. Mistakes can easily be made. In software, omitting the 500ms pause can make the lights turning on and off to be imperceptible. Similarly, in hardware stitching, the circuit can carelessly result in short circuits from crossed threads or a lack of electrical connectivity from poor knots. Thus, the interface between hardware and software debugging in a textile context presents novel challenges. Consequently, substantial instructions are included to support debugging (see Fig. 1). For instance, explaining the difference between the conductive and anchoring pins, or why you should test the code with alligator clips before sewing the circuit. Finally, the tutorial allows for personal expression. Artistic choices can be made and expressed through both textile arts and additional functionalities, allowing children to make the most of their own.

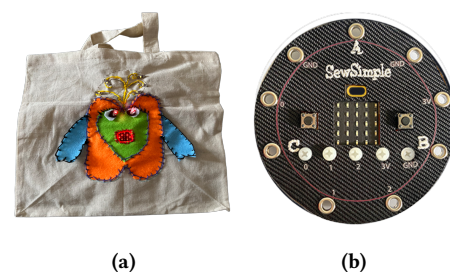


Figure 2: Final artifact from totebag tutorial (a) and “SewSimple” maker tool (b)

4 Conclusion

The “SewSimple” maker kit was created to address hardware challenges children encountered for e-textiles design and to increase the educational affordance of BBC micro:bit’s for inclusive computing

education [5, 12]. Earlier research shows that it has potential to be integrated into the English National Curriculum [6], yet teachers require substantial curricular support. Our contribution with this tutorial is the first complete resource to address this pedagogical gap. Future work should test this tutorial with educators from diverse backgrounds who teach e-textiles in the classroom. Developed by a practicing educator, this tutorial provides a practical example of how the “SewSimple” could be operationalized following the National Curriculum guidance. Additional suggestions for personalization should be included in future iterations. The tutorial demonstrates the tight interplay between technical and artistic skills required to make a functioning prototype. Ultimately, this suggests that the siloed nature of the art and design and the computing curriculum is detrimental to this type of making, and this issue should be considered by the computing education community moving forward. This artificial separation of creative subjects and computing continues to pose a barrier to increasing the inclusivity and diversity of computing as taught in KS2.

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