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A Review of E-Textiles in Learning Environments

Electronic textiles (e-textiles) combine digital technology with textile objects, and present opportunities to teach such skills as circuit design, computer programming, and iterative design. In this project, we investigate the state of the art in e-textiles for educational contexts. For example, several studies gave students with disabilities an opportunity to create their own toys and art pieces. Many studies targeted middle- and high-school children as a way to increase their knowledge of electricity and sewing techniques, but not many examined undergraduates. Therefore, in future work, we plan to conduct an experiment investigating the effectiveness of e-textiles in undergraduate learning.

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A Review of E-Textiles in Learning Environments

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Abstract

The field of electronic textiles (e-textiles) combines digital technology with textile objects, and has applications in fields such as wearable computing, theatrical design, and medicine. Prior work has examined deploying this technology in educational settings, to teach such skills as circuit design, computer programming, and iterative design. However, e-textile-based learning materials are still not commonly used, and more validated examples of such interventions would be valuable. The aim of this project is to investigate the state of the art in e-textile technology, especially in educational contexts, and to develop and evaluate an e-textiles intervention which could be deployed in a classroom or extra-curricular setting to teach introductory programming skills. So far, we have conducted a literature review examining applications of e-textiles in learning environments. For example, in one study [9], the researchers provided a safe environment for children with ASD (Autism Spectrum Disorder) to create their own sensory haptic toy. We found that many of the studies targeted middle and high school age children as a way to gauge and increase their knowledge of electricity and sewing techniques, but not many examined undergraduates. Therefore, in future work, we plan to conduct an experiment investigating the effectiveness of e-textiles in undergraduate learning.

CCS Concepts

• **Applied computing** → **Education**; Electronics; Arts and humanities; • **Hardware** → *Integrated circuits*; • **Human-centered computing**;

Keywords

E-textiles, Education, Review

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1 Introduction

Electronic textiles (e-textiles) are textiles that combine technology with fabric based materials. The applications of e-textiles are vast and can be used in many fields such as theater, wearable computing, healthcare, and education. Our project focuses mainly on the use of e-textiles in educational settings, where their integration displays a unique bond between technology and learning.

Prior work (e.g., [2]) has examined deploying this technology in educational settings, to teach such skills as circuit design, computer programming, and iterative design. This approach is supported by educational theory such as embodied learning [10] and constructionist learning [4]. However, e-textile-based learning materials are still not commonly used, and more validated examples of such interventions would be valuable. The aim of this project is to investigate the state of the art in e-textile technology, especially in educational contexts, and ultimately to develop and evaluate an e-textiles intervention which could be deployed in a classroom or extra-curricular setting to teach introductory programming skills.

In this paper, we describe a review of the existing literature on e-textiles in education. We were particularly interested in identifying trends in contexts of use, learning objectives, and measures used in this body of work, to find areas that would benefit from further research and experimentation.

During this review, we primarily found papers that provided e-textile workshops for students ranging from middle to high school. These workshops offered an excellent opportunity for teaching children skills such as circuit design, computer programming, and problem solving. The researchers also were able to include many different children from the communities who had learning disabilities or who came from struggling areas. We noticed throughout our literature review that most of the projects conducted were aimed towards a younger audience. Therefore, in our future work, we will address this gap by conducting a study examining undergraduate students learning with e-textiles.

This paper contributes an investigation into the state of e-textile technology with a focus on its applications in education. E-textiles is a field that anyone can be a part of, and we believe that the broader adoption of e-textiles into learning could enhance outcomes and experiences in both classroom and extra curricular settings.

2 Background

E-textiles, or electronic textiles, represent a fusion of fabric and technology that allows for a greater range of use than ever before. E-textiles integrate various materials such as sensors, wires, and power sources directly into fabrics to enable detection and transmission of various forms of data. The evolution of e-textiles blends together innovations from several fields including computer science, electrical engineering, medical science, and textile manufacturing. The potential applications for electronic and smart textiles are near endless, including fine arts, medical assistance, fashion, and education. The number of possible uses will only increase as e-textile technology increases in complexity.

Although the concept of e-textiles may seem very modern, one of the earliest examples of electronic textiles dates back to the ballet

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