

“I loved the activity... a great way of seeing on a small scale what can happen in the textile fiber recycling process”: University Student Perceptions of a Textile Recycling Activity

Jennifer Harmon, Erin Irick & Ayesha Siddika, University of Wyoming

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Introduction. In the driest desert on Earth, there exists a flood of at least 39,000 tons of abandoned textiles (Sparks, 2021). The discarded clothing littering the surface of the Atacama Desert near Chile’s Iquique port in the Alto Hospicio free zone arrives from every corner of the globe (Sparks, 2021; French Press Agency, 2021). The lingering, un-sellable clothing ends up in a makeshift trash dump (French Press Agency, 2021).

Literature Review. Current textile recycling efforts utilize mechanical, chemical or a combination of both methods (McKinsey & Company, 2022). These methods have received the most attention for recycling fibers from the same class or root fiber (Chen, 2021). Mechanical recycling uses forces like cutting and grinding to convert a textile back to a fibrous state (McKinsey & Company, 2022), while chemical recycling typically involves a solvent to separate different fibers and contaminants (Scott, 2022). Unfortunately, the fibers produced as a result of mechanical recycling can have quality issues, including a 30 to 40% reduction in fiber length, necessitating using these fibers in other uses (McKinsey & Company, 2022). The blend tolerance for recycling cellulose fibers from clothing is around 10 to 15% of another fiber (Scott, 2022).

Papyrus, an ancient writing medium invented by the Egyptians, predates the invention of felted sheets of cellulose fibers by approximately 3 millennia (Capua, 2014; Britt, 2000). Though the root of the word paper comes from the reed papyrus plant, it was a Chinese Imperial official, Ts’ai Lun who is credited with producing the first sheet of paper from mulberry and other bast fibers, fishnets, textile rags and hemp waste (Britt, 2000). By the later 1400s, paper mills in Europe experienced a spike in demand for paper with the adoption of the printing press (Britt, 2000). By the 1800s, paper mills in Europe and the US were routinely experiencing shortages of the cotton and linen textiles rags used to produce paper (Britt, 2000; Valente, 2014). The basic process of making paper turns fibers are into watery pulp, pressed into sheets (Britt, 2000).

University students often have misconceptions about textile recycling possibilities and processes (Kozłowski & Street, 2022). Students, in fact the US population at large, show confusion in terms of what to do with recyclable materials (Morgan, 2021). This is despite nearly unanimous support from Americans for recycling (Morgan, 2021). As a pressing issue for the industry, it is critical to have students begin to grapple with difficulties in textile recycling.

Methodology. To illustrate the potential of textile recycling, a textile recycling experiential learning activity was constructed, where students were involved in a hands-on experience of recycling cotton fabric waste into paper. 17 undergraduate students were asked to complete a reflection about the activity outlined by a series of prompt questions (Association for Experiential Education, 2019). Mechanical recycling was used to process scraps of cotton print fabric waste from cutting in an introductory sewing class. The resulting pulp was used by students to process into paper with a wire frame. A small amount of material was processed in

class during the activity to demonstrate to the students the limitations of current recycling technology. After the activity, students were asked to complete the reflection activity, using prompts. All students agreed to have the reflection responses included in this research.

The primary researcher reviewed the student responses in order to generate the initial codebook. The first author thematically analyzed and openly coded four responses to develop the initial coding categories. The second author then reviewed the codes and coding categories. Afterwards, the second author independently coded the initial 4 responses. Finally, the primary author coded all responses, consulting with the second author in instances requiring clarification.

Results. *Paper Made From Fabric Scraps*



From the 8 questions used to guide the reflection activity, 8 distinct themes emerged. The reflection texts were chunked according to themes and ranged in length from 1 sentence to 8 sentences. The themes which emerged from the student response chunks included difficulty recycling textile fibers (28 mentions), knowledge (35), difficulty in reusing textile fibers (19), improving textile recycling (15), textile recycling and corporate social responsibility (CSR) (13), recycling activity impression (23), impressions of recycled product (12) and expanding recycling (22). *Difficulty Recycling Textile Fibers.* Students revealed a variety of thoughts regarding textile fiber recycling, many involved the difficulty of recycling with the current equipment available and surprise at the amount of time it took to make the pulp for the paper. One student mentioned “...it just blows my mind that it is so hard to break fabric down.” *Knowledge.* When discussing what they learned, students primarily reflected on a variety of possibilities in terms of repurposing waste into something new. *Difficulty Reusing Textile Fibers.* In this theme, students most frequently discussed difficulties in the paper making process done in class. *Improving Textile Recycling.* Reflections incorporating improving textile recycling discussed a variety of elements including the need for more research and to cut down on the amount of time recycling needs. *Textile Recycling and CSR.* One student reflected that “...I think a lot of it (recycling) is just marketing to appeal to a consumer base that is looking for sustainable and environmentally conscious companies.” *Recycling Activity Impression.* The impressions of the activity were primarily positive though some students were concerned about the ability to scale it. *Impressions of Recycled Product.* Several students noted the differences in their paper versus commercial paper while others were surprised that paper could be made in this manner. One student mentioned “I was very confused and somewhat doubtful that the fibers would form a sheet of paper...” *Expanding Recycling.* Students reflected on expanding circularity in other products. **Conclusion.** Students revealed they enjoyed (7) this activity, finding it fun (4) and aspects of the activity unique (4), in addition to learning about some of the current challenges surrounding textile recycling. The class activity took 25 minutes of class but 5 hours to prepare the materials.

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