

Exploration of the Applicability of a Zero Waste Pattern Grading Method to Childrenswear  
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**Contextual Review.** Fabric waste from traditional garment manufacturing damages our natural environment by adding waste to landfills and by creating emissions from transporting the waste to the landfills (Carrico & Kim, 2014). On average, 15% of fabric is wasted when the fabric is cut due to spaces between the pattern pieces in the marker (McQuillan & Rissanen, 2011; Townsend & Mills, 2013). Zero waste patternmaking wastes no fabric (Rissanen & McQuillan, 2016), either through whole cloth methods or interlocking pattern pieces (Townsend & Mills, 2013). Unfortunately, zero waste patterns often only create one garment size (McKinney et al., 2020). The inability to execute zero waste patterns in a range of sizes is an obstacle to integrating zero waste designs into mainstream fashion (Carrico & Kim, 2014; Saeidi & Wimberley, 2018). Carrico (2019) developed a method for resizing garments made from zero waste patterns using narrow fabrics and trims to address this challenge. Carrico (2020) demonstrated the application of this method to a women's blouse and skirt. However, further work is needed to test the applicability of this method to other types of garments in other categories.

**Design Concept.** The purpose of this creative scholarship was to test the narrow fabric sizing method for zero waste patterns (Carrico, 2019; 2020) on a childrenswear garment. The children's size range includes sizes 3, 4, 5, 6, and 6x (girls) /7 (boys) (Joseph-Armstrong, 2010). In this size range, grading proportions differ significantly from women's sizes, as there is proportionally greater length measurement growth between sizes than in women's wear (Joseph-Armstrong 2010). Research questions were: (1) could a zero waste childrenswear pattern be graded into all the sizes in the range using fabric strips? and (2) would the method be suitable for manufacturing?

**Aesthetic Properties.** Leafy batik fabrics in nature-inspired blues and greens were selected to connect with the sustainable goals of preserving natural resources. Size gradation and repetition of diagonal lines created rhythm and movement.

**Process, Technique, and Execution.** Throughout the rigorous process of applying Carrico's (2019; 2020) resizing method to a zero waste childrenswear style, sustainability and manufacturability were evaluated and documented with images and notes (60 files total). First, a classic dress style, which would have a long lifespan (WRAP, 2013), was selected. Next, size 3 bodice and skirt sloper patterns were drafted (Joseph-Armstrong, 2010) and used to flat pattern an A-line sleeveless dress. Then, multiple sketches and mini paper patterns were created to determine cutting line placement for grading through strip insertion at necessary locations (Handford, 2003). The researcher found that inserted diagonal strips provided grading equal to two-thirds of their width in horizontal and vertical directions simultaneously. This



required fewer inserted strips, reducing sewing time and improving manufacturability. The size 3 dress patterns were traced and cut along strip insertion lines. Seam allowance of ¼" was added. The size 3 pattern pieces were arranged into a nearly zero waste layout that required 20 ½" of 44" wide fabric cut on the fold. A fit muslin was sewn.

Forty-four inch wide fabrics were sourced, and 100% cotton wovens were selected for their washability and durability for childrenswear (WRAP, 2013). The original uncut size 3 dress pattern was graded into sizes 4, 5, 6, and 6X (Handford, 2003). The size 3 pattern pieces were overlaid on each size to calculate needed strip widths. In addition to the initially planned diagonal strips, strips were required at the side and shoulder seams. To reduce sewing labor, front and back strips at the shoulder and side seam were combined.

Fabric for sample garments in sizes 3, 5, and 6x was cut out with a rotary cutter and accurately stitched together with a lockstitch machine and overedge machine. Each seam was pressed before crossing with another seam. As the size 3 did not require enlargement, folded fabric strips in graduated sizes were inserted into the seams to maintain the aesthetics. Edges were finished with binding.

Cohesion. The aesthetic properties, process, technique, and execution of this design were aligned with the sustainability goals of the zero waste strip grading method (Carrico, 2020a, b). Aligned choices included durable fabric, timeless style, durable seam types and finishes, and fabric (WRAP, 2013) with a nature-inspired motif and colors.

Contribution: Evaluation of the research questions yielded new knowledge and areas for future research:

- A zero waste childrenswear pattern can be graded into all the sizes in the range using fabric strips. This research demonstrates that the Carrico (2019; 2020) strip grading method can be applied to a children's garment.
- The method is suitable for manufacturing in some ways. A marker could be created for manufacturing from the cut-on-fold layout was used for sample development. The ¼" seams used throughout the designed pattern allowed for manufacturing-aligned construction practices. The twelve pattern pieces plus bindings used in each dress cost about 4 hours in sewing time. Future work may consider how the number of pattern pieces or sewing time may be reduced to improve manufacturability. As grading occurs only in the strips, not the main pattern pieces, garment proportions did not grow uniformly, as in traditional manufacturing. Consumer evaluation of aesthetics achieved with the strip method of zero waste pattern grading is needed.

Additional contributions include:

- The strip grading method promotes mainstream fashion integration of zero waste patternmaking by providing a solution to the common problem that zero waste patterns only work for one size (McKinney et al, 2020). It also provides an avenue to reduce waste by only producing garments in sizes ordered. Because the marker is not size-specific, a manufacturer could efficiently cut multiple garments by layering the fabric and then cut the needed strip sizes as orders are received.
- Grading effects of using diagonal strips are specified (Simultaneous vertical and horizontal grade equal to 2/3 of the strip width).

Originality and Innovation. This submission fills a gap in the knowledge of grading zero waste, specifically the applicability of the narrow fabric method (Carrico, 2019; 2020) to childrenswear. Strengths and opportunities for manufacturing with this method are identified.

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