American, and Mexican American) to explore the experiences of these parents and their children's racial representation in children's literature. Findings revealed that parents contended with challenges to gaining access to quality children's literature with authentic representation, such as having to go out of their way to obtain books that reflect positive images and family values. Parents also described the possibilities such representative literature affords their children. Some families even displayed a proactive approach in leveraging inspirational, representative books to counteract society's restrictive norms/ideas about what kinds of lives underrepresented minorities along with their children can lead. My goal for this research was to inform teacher education, expand criteria for selecting books, and insist working with families can help students thrive.

Research advisor Christy Wessel-Powell writes: "Kayla's independent research interviewing families about their children's access to authentic and positive representations in books is an important contribution to the field of education and children's literature. BIPOC parents' experiences are key, and currently underresearched. She has been recognized by Purdue University's Center for Families for her work."

ENGINEERING

Liquid Nitrogen Shrink-Fitting Process

Student Researcher: *Natalie Harvey, Junior*

There are many ways in which the assembly of two parts can be incredibly difficult, if not impossible, to accomplish without using some sort of machinery or specific processes. What happens when it is physically impossible to fit one part into another in an attempt to assemble them? In this scenario, a shrink-fitting process was utilized. In this process, the inner component needed to be cooled in order to shrink it, and the outer component needed to be heated to expand it. Once the parts have been cooled and heated, they can be assembled easily, and when returned to normal temperatures, they fit so tightly that they cannot be disassembled. To complete this shrink-fitting process, the inner component is dunked in liquid nitrogen in order to cool the part rapidly. Since this liquid nitrogen use was unprecedented, it required research and testing. After exploring

Inner component after being submerged in liquid nitrogen.

the safety requirements of liquid nitrogen, then going through some predictive calculations to estimate the amount of time the inner component would be submerged in liquid nitrogen to reach the desired size, the parts were tested in liquid nitrogen. As seen in the image, the part was cooled significantly during its time in the liquid nitrogen, and it was determined that it required 47 seconds to fully cool the part to an equilibrium temperature. This step was implemented into a full assembly process in which the tooling and assembly cell were designed. The cell autonomously assembles the parts, and after analysis, it was predicted to output a completed assembly every 60 seconds.

Research advisor Todd Lillian writes: "At her internship, Natalie Harvey investigated the timescale necessary to cool parts for a shrink-fitting assembly process. Her findings may be used in the design of tooling and the timing of steps in this process."

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