



This is a cocoa tree in one of the many cocoa plantations in Côte d'Ivoire.

such a program may be emphasized through government aid. With the current financial institutions and technology available in Côte d'Ivoire, it is feasible for a microfinance program, following the lessons from the case studies, to be implemented for farmers.

Research advisor Colin Sullivan writes: “Erin’s research explores the obstacles preventing developing countries from capturing a larger share of the profits from their natural resources. Focusing on the potential for microfinance to encourage entrepreneurship, she applies lessons from case studies around Africa to give insights into cocoa production in Côte d'Ivoire.”

## EDUCATION

### “We Flourish”: The Role of BIPOC Parents in Diversifying Children’s Literature

*Student researcher: Kayla Neal, Senior*

When obstacles threaten to hamper young children’s educational growth, self-image, and aspirations, parents are key stakeholders in removing barriers. Parents have meaningful truths to share about reading materials that engage, inspire, and instruct their children best, and one important group often underrepresented in the discussion is BIPOC parents. Educational research has brought diverse representation in children’s books into greater focus, often with the metaphor of books as windows, mirrors, and doors for children to see themselves and others represented, an analogy coined by educational researcher Rudine Sims Bishop. For such books to have meaningful impact, a partnership is required that authors, teachers, administrators, and children can’t fulfill alone: parents are essential informants.

This qualitative study uses thematic analysis of interviews with five parents of elementary students of varying racial backgrounds (African American, Filipino



Example of diverse children’s literature.

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."*