University of Northern Iowa's Textile & Apparel Program (TAPP) has a National Science Foundation funded Product Development and Material Analysis laboratory. Under the direction of Dr. Mitchell Strauss, Professor in the School of Applied Human Sciences, equipment in this laboratory is used by faculty and undergraduates to investigate the properties of fabrics and fibers. The equipment in the lab is used to test swatches (fabric samples) to discover under what conditions they will fade, rip, pill, stain, burn, and wear. Common words heard in the textile laboratory to describe the properties of fabric are friction, shear, drape, warp, and weft.

Jordan Caruso, UNI TAPP major, tests for shear, drape, and other properties using a new and unique machine to the lab, the MARK-10. UNI owns one of the first MARK-10 instruments on the market. Jordan is piloting its calibration as part of her undergraduate research with Dr. Strauss. The MARK-10 allows Jordan to gain a deeper understanding of how different fabrics respond to various stresses. The data provided by the MARK-10 will help designers and researchers determine if a specific fabric will work for a particular application and how a garment and fabric will lay when being utilized or worn by a person.

The MARK-10 is a low-load testing machine. This means it only needs a small sample of fabric in order to obtain measurements and the fabrics are not damaged in the testing process. It is used to measure friction, shear, warp, weft, and bend of a swatch sample when exposed to stress. Friction, the resistance of the fabric when it is dragged across a surface, can affect fabrics in different ways such as how they fall and move when worn. Shear, the tensile strength or how much force is required to rip the fabric, is tested at a diagonal to the weave. Warp and weft tests evaluate the tensile strength of the fabric in the horizontal and vertical directions. The bend test is a simple test of how far a fabric can be pushed over an edge before it falls to a 45° angle. Some fabrics bend right away while others do not. Each test is completed in with 5 swatch samples, and the scores are averaged to ensure accuracy.

These tests are also completed at different levels of humidity. Fabrics, such as cotton, can get stronger with humidity while others, such as rayon, become weaker. The tests for the fabrics are completed at 90% humidity and 0% humidity. The room is at a constant temperature of 70° Fahrenheit (±2) and humidity of 62° (±2). Fabrics to be tested at a 90% humidity are placed in a machine to increase the humidity, placed in a Ziploc bag or an air-tight plastic container, and stored until tested. The 0% humidity test requires that fabrics be placed in an oven at 65° Fahrenheit for 4 hours, so that the fabric is at equilibrium and has time to dry. It is then transported to the lab in a special container, to maintain the lack of moisture, until testing.

These measurements of how individual fabric types react are valuable to help fashion designers select the best fabric for a new design or pattern. Jordan uses a program called Optitext to combine the fabric data with the garment pattern. The pattern
data will include pieces such as the front, back, sleeve, leg, pockets, etc. A 3D model of a figure wearing the garment allows Jordan to test out different fabrics virtually. One of Jordan’s tasks is to calibrate the machine/program so that it will be easier to use and more valuable to designers in the future. She tests the accuracy by making a sample garment to compare to the virtual one. The goal is to have an accurate computer generated model identical to one in real life so that researchers, like Jordan, may imagine, or predict, how a fabric will look, act, and wear as a skirt, shirt, or some other garment or as a home good such as a curtain.

Using the Optitext to model how different fabrics respond differently to the same pattern will help designers streamline getting clothing to the stores by eliminating some steps. Currently, fashion designers design a product, make a sample, and have a model try it on. Much time is spent waiting for the sample to be made and shipped, typically from overseas. If the garment does not look or wear as it was intended then there is a redesign, a new sample made, and tried on again. This process continues until the garment is what the design intended. Optitext, once calibrated, will provide a designer with virtual garments. Without the need for a sample, initial adjustments can be made and only one or possibly no samples will need to be sewn prior to production. So a process that once took months could be completed in a much less time.

Jordan’s work demonstrates that fabric can be very complex in its composition. How often do we put on clothing and not even give the fabric, the yarn or even how the individual threads are twisted a single thought? The textile industry depends on material science to select the right fabric for the right purpose.

The tiny details that affect how a fabric is worn and acts are interesting to Jordan. She is more interested in the fabric and testing of the fabrics than she is in the designing of apparel. Her first semester in college was at a school in New York City. She wanted to be a part of the apparel industry. It was here that she realized that she preferred the textiles over design. One of her professors, who was an expert in fabrics, enjoyed and made textiles fun. He was one of the reasons she decided to pursue this area. After one semester in NYC, Jordan returned to her home of Cedar Falls and began her education at UNI continuing to learn more and test fabrics under the direction of Dr. Strauss.

Jordan will graduate in May of 2018. One of her goals of her undergraduate research project, is to figure out how to properly calibrate the Optitext program so that it can mimic fabrics accurately. Knowing about these kinds of tests and the MARK-10 in particular, is a skill that Jordan hopes to continue to develop in her future career.