Interactive 3D garment simulation: A technologically enhanced and leading patternmaking tool with project-based learning methods virtual setting

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This paper provides information and insight about using three dimensions in teaching patternmaking software. In particular, it addresses the advantages of using 3D garment simulation in advanced patternmaking courses for upper-level fashion design students. Such simulation will enhance their technical design learning experiences in a virtual setting. 3D garment simulation has been used as a tool to enhance students' understanding of 3D concepts in medicine, architecture, science, accessory design, and automotive industry design (Korakadis, Pavlatou, Palyvo, & Spyrellis, 2009; Perdomo, Shiratuddin, Thabet, & Ananth, 2005; Silen, Wirell, Kvist, Nylander & Smedeby, 2008). The digitalization of the design process in the fashion industry has been slower than in other industries, but 3D garment simulation has begun to change the fashion industry as today's new fashion designers combine both analog and digital design processes (Siersema, 2015). Therefore, it is important to prepare fashion design students with proper digital techniques and knowledge so they will be equipped with new virtual fashion design processes and design thinking.

The objective of this course project is to teach students use of the patternmaking software program, OptiTex, to create a production garment for a number of apparel markets and make patterns by using additional software called CLO3D, which allows 3D garment simulation to analyze the fit to the body while using a dressform and a 3D virtual model avatar. By using two software programs simultaneously, students learn to adapt effortlessly to any type of patternmaking software when they transition into the fashion industry.

In order to understand foundational knowledge and skills in 2D patternmaking and 3D garment simulation techniques, students learned to use different types of tools in OptiTex to draft advanced patterns by completing in-class assignments during the first five weeks. Students also learned to create a spec pack and marker using the 2D patternmaking program, which allowed them to understand the product development process in general. At the fifth week of class, students learned 3D garment simulation using CLO3D, where they were able to reproduce physical properties of fabrics to visualize the way they drape in real life. By illustrating a 3D simulation, students were excited that they were able to sew virtually and see 3D finished products without cutting and sewing actual fabric.

After 5 weeks of in-class assignments, students had two projects (date night dress, cut and sewn knit) to finish within twelve weeks. The projects were designed to allow each student to conduct market research and create necessary patterns to develop a production sample for mass productions to be sold at large retailers. First, the pattern was drafted using 2D patternmaking software, Optitex, and exported to CLO3D. Second, the 3D avatar was adjusted to fit into the size of a dress form size 8. Third, students draped the first muslin using 3D simulation on an avatar to test students' initial ideas and concepts for chosen fabrications. This first 3D simulation was used for design iterations where students could analyze fit and modify design idea for the groundwork of a new style development. Fourth, students made markers to print patterns after completing 3D modeling. Based on their 3D garment simulation, students had to create the second muslin to analyze the fit of the 3D simulation modeling. Lastly, the students assembled the final package for each project, comprising the marker, digital pattern, 3D simulation, second muslin, full production package, including spec and technical pack, and the final garment. These projects helped students to understand that 3D garment simulation will reduce the time of sample production, from days to weeks and even more. However, students faced challenges while using 3D simulations to accurately analyze the fit, given that the computer screen only displayed 2D, and to connect the 3D virtual model to an actual dress form.

With rapid technology development in the fashion industry, incorporating state-of-the-art technology into design class projects is an essential part of our design education today. Furthermore, teaching 2D patternmaking as well as 3D garment simulation contributes to students future sustainability practices as those digital processes can reduce the cost of sample production and transportation as well as save time. This project will continue to develop a more advanced, combined, and embedded digital printing technology and to experiment with different types of up-to-date technology, such as a body scanner and 3D printer.

<div align="center">References</div>

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