Curriculum Development for STEAM Cooperative Learning to Research and Design Cotton Intimates

Ling Zhang, Rachel Eike, Courtney Barbour, Iowa State University, USA

Background & Purpose. Intimate apparel has become a crucial category of clothing for modern women, with an estimated value of approximately $80 billion USD in 2021 (Kharrati, 2022). Considered to be a necessity category of apparel, intimates are projected to continue expanding as an industry (Monget, 2015). However, despite its significance, few public university apparel programs offer courses that include intimate goods in their apparel curriculum. To address this gap, and enhance students' competitive ability in their future careers, students enrolled in four different courses within an apparel program at a land-grant university took part in the 'Cotton in the Curriculum Development Project' funded by Cotton Incorporated. The project aimed to integrate STEAM, cooperative learning, and cotton fundamentals, performance, and sustainability, into the apparel design and product development curriculum by using intimate wear as the common category of goods in select classes throughout the curriculum. The term "STEAM" refers to STEM plus the arts, emphasizing inquiry and problem-based learning methods commonly used in the creative process (Wade-Leeuwen, Vovers, & Silk; 2018). The primary objectives of this project were to showcase the positive attributes of using cotton as the preferred fiber for intimate wear via course activities and projects, and to offer students a learning opportunity that emulates the collaborative, interdependent operations of the fashion industry.

Theoretical Framework. To achieve the objective of concentrating on the utilization of cotton in intimate wear while simultaneously fulfilling specific course competencies, a multi-course collaborative project that integrates cooperative learning theory was developed. Cooperative learning theory proposes that by working in small groups, students can "maximize their own and each other's learning" (Johnson, Johnson, & Holubec, 1993, p.6). Previous research has shown that learning in a collaborative environment is advantageous in education, as learners gain insight to other's perspectives and experiences in order to problem solve and develop a deeper comprehension and meaning in their own learning (Rutherford, 2014). Although cooperative learning has been implemented in other disciplines, it has not been widely used within apparel design curriculum. Hwang, et. al. (2015) conducted a study on an apparel drawing course to assess the effectiveness of cooperative learning in comparison to individualistic learning. Findings from the study indicated improvement in students' communication and critique skills and supported the use of cooperative learning in apparel-based curriculum.

Implementation. Within this multi-course collaboration, student teams in each course performed tasks representative of what is experienced in the industry. Some of the 'industry' units or departments included: Trend and Design, Surface Design/Art/Collection, Patterning and Sample-making, Product Development, and Manufacturing. Each class first learned content

connected to cotton, as appropriate to the course level, course competencies, and specific skills taught. Learning materials were developed based on the resources provided by Cotton Incorporated, including access to Cottonworks.com, Cottonleads.org and Cottontoday.com. After learning relevant content, students then prepared informed work for the collaborative project as it aligned with their specific class. Once completed, students enrolled in the multi-course collaboration project and shared their work with the corresponding team members (in another class/unit) to build a cotton intimate wear item or collection. For example, students in *CAD patternmaking* created a bra pattern using Lectra Modaris software while students in *Integrated Textile and Fashion Design* designed and printed multiple motifs and colorway options for fabrication of the bra prototype. Samples were printed and discussed between classes (teams) for scale and print appropriateness, as determined through trend research. Details of pattern/style, colorways, and textiles were shared with students in the *Technical Design Processes* class to develop a technical package using PLM software. Further, materials were then handed off to student teams in *Apparel Production Management* to develop a marker and manufacturing plan the bra style(s). At the end of the semester, students in each class prepared either an individual or joint final presentation (poster or series of presentation boards), which were delivered to industry guests via a Student Showcase event. Industry guests, representing creative design, functional design, and product development from regional apparel companies (private to mass corporate institutions) evaluated students work and provided feedback to each group. Figure 1 details a production development model outlining how courses enrolled in the multi-class collaboration assumed 'industry' roles. The production development model was developed and modified from the Revised Apparel Retail Product Development Model by Wickett, Gaskill, & Damhorst (1999).

Figure 1. *Apparel Curriculum-Industry Educational Role-Playing Collaboration Model*
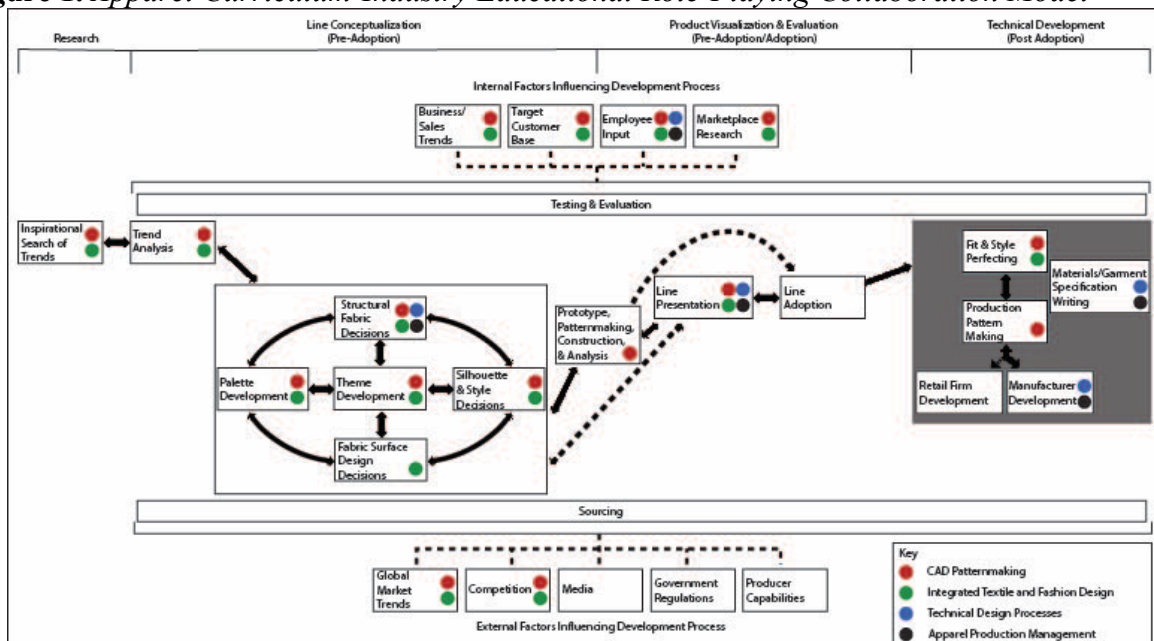
Innovative teaching tools were applied in each of the courses outlined, including activities using the university's online course management 'Canvas' platform, virtual discussions, CAD pattern making, 3D virtual fitting (CLO3D), Product Lifecycle Management (PLM) program, lab experimentations, industry expert presentations, and the Cotton Incorporated Headquarters' study tour, held in the Fall of 2022. Eight students who performed at the top of their class during the Spring 2022 Cotton in the Curriculum Project (as selected by industry guests of the Cotton in the Curriculum Student Showcase Event) were invited to attend the Headquarters' study tour and were accompanied by the three advising faculty members. During the tour, students and faculty toured the facility and participated in live lectures and discussion led by industry experts. Post-project survey data were collected from all students involved in the collaborative educational project to quantify learning impact as supported through course and project student learning objectives. Informal interview data from industry guests on structure of project and student outputs was also gathered. These data informed future iterations of the collaborative project.

Conclusion. Through a STEAM learning approach, students were engaged in research, design, production, and evaluation of cotton intimate wear, providing them with practical experience in utilizing cotton in the intimate wear industry and fostering a collaborative learning environment. Further phases of this research continue building upon the foundation set through this program and refine the collaborative project to improve communication between courses/teams as well as offer additional student learning opportunities involving apparel merchandising curriculums to address gaps in the existing production development model.

References:

Johnson, D., Johnson, R., & Holubec, E. (1993). *Circles of learning: Cooperation in the classroom (4th ed.)*. Edina, MN: Interaction Book Company.

Kharrati, K. (2022, November 1). Global Intimate Apparel Market Share Likely to Grow At a CAGR of 2.5% By 2030. *Custom Market Insights.* https://www.custommarketinsights.com/press-releases/intimate-apparel-market-size/

Monget, K. (2015). State of the Intimate Apparel Industry. *Sourcing Journal (Online),* https://www.proquest.com/trade-journals/state-intimate-apparel-industry/docview/2276428909/se-2

Rutherfod, S. (2014). Collaborative Learning: Theory, Strategies, and Educational Benefits. Nova Science Publishers, Inc.

Wade-Leeuwen, B., Vovers, J., & Silk, M. (2018, June 10). Explainer: what's the difference between STEM and STEAM? *The Conversation. https://theconversation.com/explainer-whats-the-difference-between-stem-and-steam-95713*

Wickett, J., Gaskill, L., & Damhorst, M. (1999). Apparel retail product development: Model testing and expansion. *Clothing and Textiles Research Journal, 17*(1), 21-35. https://doi.org/10.1177/0887302X9901700103

Hwang, C., Zhang, L., Rorah, W., Thomapson, K., & Sanders, E. A. (2015). Pilot Study of Examining the Effectiveness of Cooperative Learning (CL) vs. Individualistic Learning (IL)

in Fashion Illustration Class. International Textile and Apparel Association Conference Proceedings, Santa Fe, New Mexico. https://dr.lib.iastate.edu/handle/20.500.12876/50794