



Textile and Apparel Curriculum Development for Sustainability Education

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Textile and apparel products cause significant environmental and human health problems in their lifecycle including during production, use, and end of use. Textile wet processing uses large quantities of chemicals, water, and energy. The production of synthetic fibers uses petrochemicals derived from depleting resources. Consumer care uses large quantities of water or energy. After consumers' use, large quantities of used products may be sent to landfill.

To solve these problems and progress toward sustainable development, the textile and apparel industry and organizations have developed a number of initiatives, e.g., the Sustainable Apparel Coalition (SAC)'s Higg Index, Zero Discharge of Hazardous Chemicals (ZDHC), and Levi's E-valueate and Water<Less (O'Rourke, 2014). Higher education institutions also incorporated sustainability in apparel design and merchandising curriculum. Many of the curriculum revisions focus on the development of one new course, e.g., (Abner, Baytar, & Kreiner, 2019; Cao, Frey, Farr, & Gam 2006). Though the importance of sustainability in the textile and apparel industry is widely acknowledged, there exists a gap between industry needs and college curricula in textile and apparel.

A team of university faculty has developed a textile and apparel curriculum to integrate sustainable textile and apparel concepts into college courses and participatory learning experiences. The tasks of the curriculum development project included: (1) revising four existing courses (Fundamentals of Textiles I, Fundamentals of Textiles II, Fashion Sustainability, Advanced Apparel Product Development); (2) developing two new courses (Lifecycle Approach to Design, Business Model Innovation); (3) creating a "Sustainable Apparel and Textile Innovation" minor; (4) establishing a pop-up sustainable apparel store; and (5) evaluating, revising, and disseminating the curriculum.

The revision of existing courses and development of new courses incorporated case studies and problem-based learning (PBL) projects in courses. Sustainability case studies have been developed through desktop research on sustainability practices of more than 15 textile and apparel companies such as Patagonia, Eileen Fisher, Cotton Inc., Nike, and H&M, and interviews with a number of industrial professionals from companies such as Gravel & Gold, Levi Strauss, GAP, Yerdle, and Cradle to Cradle Products Innovation Institute. The PBL projects are based on real-world environmental problems encountered by the textile and apparel industry such as large quantity of solid textile waste that cannot be sold in Goodwill thrift shops, strategies to accomplish zero discharge of hazardous chemicals, design and develop sustainable apparel products. The four revised courses have been taught multiple times since Fall 2016 semester. The researchers reported the details of the PBL projects and the students' learning outcomes in these 4 courses taught in Fall 2016 semester (Cao, Carper, Cobb, Silverman, &

Jelenewicz, 2017). The new course “Lifecycle Approach to Design” was taught in Fall 2018 semester, and the new course “Business Model Innovation” is taught in Spring 2019 semester.

A minor “Sustainable Apparel and Textile Innovation” has been created and approved by the university in Spring 2017. This interdisciplinary minor requires 18 credit hours: 6 credits of required core courses in fashion sustainability; 3 credits of elective course in “Design for Social Change”; 3 credits of elective course in “Business and Industry Innovation”; 3 credits of elective course in “Science and Engineering Innovation”; and one more 3-credit elective course.

A sustainable apparel pop-up store consisting of a mobile showroom and online marketplace was established to provide opportunities for students to have career mentoring and participatory learning experiences. The pop-up store has been implemented in two different classes in Spring 2018 and Fall 2018 semesters. The researchers reported the details of pop-up store and student learning experience (Cobb, Born, Shaffer, Cao, & Jelenewicz, 2019).

The curriculum development project was evaluated with a focus on answering the following 4 questions. The evaluation results in 2017 (Spring and Fall semesters) and 2018 (Spring and Fall semesters) are summarized below.

Do courses feature sustainability content and PBL processes? An “Instructor Checklist” was created. Faculty used the checklist to document their curricular and pedagogical shifts in the courses. It was found that faculty addressed sustainability concepts, integrated case studies, and featured PBL projects in the courses.

Do students gain sustainability content knowledge in each course? Data was gathered using two sources: in-course pre- and post- quizzes and student surveys. To assess short-term effects of the courses on students’ sustainability knowledge, faculty created quizzes tailored to reflect the sustainability content covered in their courses. A total of 603 students completed both the pre- and post quizzes across all courses offered during the 4 semesters. All students demonstrated short-term gains in their sustainability knowledge. The survey questions included the Environmental Apparel Knowledge (EAK) scale (11 items) and the Sustainable Apparel-purchasing Behavior scale (8 items). A total of 60 and 74 students completed both pre- and post-surveys in 2017 and 2018, respectively. The results are similar in the two years. Students’ mean EAK scores were significantly higher on the post-survey, which indicated students experienced short-term gains in their knowledge of apparel environmental issues. Students’ mean scores regarding their sustainable apparel purchasing behavior were split; half of the items increased and half decreased. None of the changes from pre- to post- survey were statistically significant.

Do students demonstrate analytical, problem-solving, and decision-making skills? Faculty used grading rubric to evaluate their students’ PBL projects. In both 2017 and 2018 (4 semesters), students overwhelmingly demonstrated their analytical, problem solving, and decision-making skills in their completed PBL projects.

Do students who participate in the pop-up store gain useful experiences in sustainable textile and apparel? In Fall 2018 semester, 35 students completed a survey on their experiences in the pop-up store. Fifty-eight percent of the students indicated they believe the pop-up store experience was relevant to their future career. Most (>80%) students indicated their skills/abilities were improved as a result of participating in the pop-up store.

An innovative curriculum has been developed to educate the next generation of textile and apparel professionals and help the industry accomplish sustainable development. The curriculum includes revised and new courses for design and merchandising majors, a new minor to teach students who are interested in a career in the textile and apparel industry, and participatory learning experiences in a pop-up store. The curriculum increased students' sustainability knowledge and helped students gain relevant practical experiences.

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