Incorporating a Medical Apparel Project into a Technical Design Process Course in an Apparel Design Program

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Background and Problems. The global medical clothing market, including medical apparel, will reach approximately 2,967 million U.S. dollars by 2024, according to the Zion Market Research (2018). Medical apparel products are categorized as disposable and reusable. They include different types and apparel of protective attire (gown, scrubs, glove, caps, shoes, etc.) that cover every part of the body. Such apparel (surgical, patient, or isolation gowns) protects users against blood and other chemicals at a hospital and during surgery. Learning about apparel needs in the ever-growing medical industry and working to solve clothing-related situational problems, however, poses a major challenge for students learning how to design these products. It is challenging for students to learn critical-thinking and problem-solving skills for medical apparel due to a lack of information about medical apparel and a vast market in medical industries. Most healthcare facilities provide tie-in-the back versions of medical apparel, which are often humiliating, uncomfortable, or unattractive, are made of disposable paper, which can cause discomfort, and are overly thin or have an inappropriate fit, like gowns with one or limited sizes (Tedeschi, 2018). Despite these problems, there is a lack of medical apparel design research on the issue, and critical challenges still exist in developing worthwhile designs that will improve this apparel. Healthcare facilities should consider offering high-quality, functional gowns for maximum comfort and coverage. The Coronavirus pandemic leads to not only the extreme shortages of medical attire supplies for doctors, nurses, and healthcare workers but also new attention to the need for sustainable protective medical garments and design (MarketWatch, 2020). Therefore, the purpose of this study was to investigate university students' active learning during a medical apparel project in a technical design process course. Students were encouraged to identify design problems, create their own pattern-making techniques, and understand the entire process through a project that was part of a real-world design competition held by one of the largest medical apparel companies.

Methodology. Institutional Review Board (IRB) approval was obtained from the University's Human Subjective Review Committee before conducting data collection of this study. Data were collected at the end of the course using a questionnaire asking students to evaluate their learning experiences in the medical apparel design project. A total of 43 undergraduate students enrolled in a 400-level university class (Technical Design Processes) in an apparel design program participated. Most students were female ($n = 39$; males of $n = 4$) and ranged in age from 22 to 28

years (mean age of 23.5 years). Eighty-six percent of students were seniors, and 14% were juniors. Less than three students were assigned to each team, so a total of 15 teams participated in the course project. The questionnaire elicited participants' demographic information and also included 14 questions gauging students' levels of satisfaction regarding the project based on a seven-point Likert Scale, ranging from "1" as strongly disagree to "7" as strongly agree, adapted and modified from an existing study (Ma & Lee, 2012). SPSS 20 software was used to perform basic descriptive statistics for the demographic data and analyze quantitative data from the items using an independent sample *t*-test.

Results. For each student, responses to the 14 evaluation items were divided into two groups – satisfied ($n = 22$) and dissatisfied students ($n = 21$) based on an analysis of results from the independent sample *t*-test (see Table 1). The results revealed a significant difference between the two groups ($p < 0.05$) on all of the items. Satisfied students' responses yielded higher mean scores than those of unsatisfied students on all items. Findings showed that half of the students had a positive learning experience solving problems and strengthening their knowledge in current commercial medical apparel through the project. On the other hand, half of the students had a negative learning experience, responding that "*the project was little related to course content*," or they experienced "*insufficient time (working duration)*," and "*a heavy workload (five assignments and three exams)*," and "*rigid restrictions for project creativity (using limited materials provided)*." In light of the noted pros and cons, we believe that the project was helpful and valuable for students' learning and preparation for their future work experience.

Effectiveness of the Strategy and Future Plans. The incorporation of a medical apparel design project into coursework can provide students a great opportunity to enhance critical and creative thinking skills as well as foster close collaboration amongst classmates. Given the negative outcomes in the project evaluation, a similar project may be necessary to develop appropriate course content in classes related to the subject (e.g., 3D soft goods and pattern-making courses or protective clothing design courses). However, given the positive outcomes in the project evaluation, students were excited about a new learning activity, convinced of its real-world relevance, and enjoyed the collaboration the project facilitated. Participants enjoyed developing a new medical gown and facemask, although the entire process was complicated by unpredictable situations (e.g., a tight course schedule and no detailed criteria). Design criteria and guidelines of the projects may be necessary and helpful to students engaging in the project because the students had no previous knowledge about or experience with the design of medical or protective products. Through this project, students obtained a further understanding of the value and usefulness of medical apparel. Educators consider adding a fundamental course related to medical or protective apparel in the fashion design curriculum to promote students' reconsideration of medical or protective products. Consequently, design students can contribute to the growth of the medical or protective apparel market in the future. We suggest providing an opportunity for students to attend a variety of design competitions through this and other related projects.

Table 1.
T-test Comparisons of Satisfied and Dissatisfied Student Evaluation

Questions	Participants (N = 43)		MD	t-value
	n = 22 ^a	n = 21 ^b		
	Mean (SD)	Mean (SD)		
1. The project comprised complex activities.	5.68 (1.32)	3.19 (1.78)	2.49	5.229***
2. The opportunity to collaborate with other students.	6.14 (1.17)	4.57 (1.86)	1.57	3.322**
3. The project had real-world relevance.	5.86 (0.94)	3.52 (1.63)	2.34	5.794**
4. A variety of resources were used to complete the project.	5.23 (0.97)	3.71 (1.79)	1.66	3.910***
5. The project provided the chance to examine the tasks from different perspectives rather than a single perspective.	5.23 (1.23)	3.71 (1.79)	1.51	3.238**
6. The project allowed competing solutions and diversity of outcomes rather than a single correct response.	5.50 (1.10)	4.05 (1.94)	1.45	3.072**
7. The project made me think about a lot of issues.	6.14 (1.13)	4.43 (1.99)	1.71	3.072**
8. The project helped prepare me for work in the textile and apparel industries.	4.64 (1.56)	2.71 (1.52)	1.92	4.088***
9. The project helped me acquire job-related knowledge and skills.	4.09 (1.74)	2.81 (1.37)	1.28	2.675*
10. The project helped me think critically.	5.14 (1.21)	3.38 (1.66)	1.76	3.983***
11. The project helped me think clearly about the material.	3.95 (1.50)	2.86 (1.32)	1.10	2.551*
12. The project was a worthwhile experience.	4.82 (1.62)	2.52 (1.40)	2.29	4.973***
13. The project helped me solve complex real-world issues.	5.00 (1.45)	3.05 (1.60)	1.95	4.205***
14. Overall, this project was a valuable learning experience.	5.41 (1.30)	3.10 (1.45)	2.31	5.530***

Note. a = satisfied students, b = dissatisfied students, SD = standard deviation, $p < 0.05^*$, $p < 0.01^{**}$, $p < 0.001^{***}$.

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