



Increasing environmental awareness through Project-Based Learning (PjBL) containing sustainable fashion.

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1 INTRODUCTION

Fast business model fashion encourages rapid changes in clothing models and production on a large scale. The price of clothes sold by fast fashion businesses is also cheap but they are less durable, so more clothes are thrown away after a few uses (Centobelli et al., 2022). Many used clothes are not recycled but end up in landfills (Shahid et al., 2024) (Ronda, 2024).

Disposal of textile dyeing waste is also not in place so it can pollute the water environment and disturb organisms in the water ecosystem. Textile dyeing process wastewater contains high concentrations of dyes and chemicals that can disrupt the natural balance of aquatic ecosystems. This will result in changes in the population of aquatic organisms, cause a decrease in water quality, and damage the sustainability of the ecosystem (Samchetshabam et al., 2017) (Mu et al., 2023). Apart from water pollution, textile waste also causes soil pollution which can reduce soil fertility and affect surrounding agriculture (W. U. Khan et al., 2023) (Foorginezhad et al., 2023).

Awareness about the environmental impact of textile waste is still lacking among producers and consumers (M. I. Khan et al., 2023). Many people don't know how to recycle clothes they don't use anymore. Supporting clothing designs that are more durable and easily recyclable is an important issue. To create beautiful and environmentally friendly textile designs requires the cooperation of various parties, especially the role of textile designers. Students of the fashion design education study program are one of the main forces in textile design. Therefore, it is very important to increase environmental awareness among students, especially students in the Fashion Design Education Study Program.

The driving factor for environmentally friendly or caring behavior is awareness of environmental problems and special steps to achieve environmental sustainability. Caring for the environment is realized through knowledge, moral values and an attitude of loving the environment (Lavuri et al., 2023). Environmentally caring values have a positive effect on behavior. Lack of knowledge can lead to reluctance to participate in sustainability-oriented activities and actions, can contribute to environmental damage, and may worsen global warming.

Students are future assets to continue environmental conservation efforts. Natural resources are capital for economic growth as well as life support (M. A. Khan et al., 2024; Kindo et al., 2024). Higher education is a means to achieve this goal, therefore it is necessary to prepare adequate infrastructure and competent human resources. Apart from that, strategies and learning models are also needed that can foster an attitude of caring for the environment. Learning must be student-centered, so that understanding of the required knowledge and skills can be obtained optimally (Woods & Copur-Gencturk, 2024). Currently, many institutions in Indonesia are ready to contribute to forming an intelligent and environmentally conscious society, but only a few of

these institutions are truly ready to provide an adequate curriculum. Therefore, the importance of educational institutions arises to provide future professionals and aspiring designers with environmentally friendly fashion design knowledge and skills.

Economic demands, especially profit factors, force textile producers to ignore environmental factors. However, when reviewed for further long-term benefits, eco-friendly design concepts are much more profitable from an economic point of view. Because it can be easily maintained, does not violate natural laws, prevents disasters, uses recycled and green materials, and minimizes the use of hazardous materials (Acuti et al., 2023)(Gurova, 2024).

Considering that the global environment is not going well requires designers to immediately switch to educational models that are relevant to current climate conditions, to be able to present solutions and overcome problems that occur in society (Mel & Tarnovskaya, 2024). Climate change is a global concern today, therefore various educational approaches incorporate aspects of the environment and climate change into their curricula throughout the world, including architectural education. In addition, various strategies have been used to achieve continuing education goals, either through additional training, private courses or blended learning models (Ramísio et al., 2019).

It is hoped that all these efforts can increase awareness of the importance of caring for the environment. For example, in the textile technology class, the Yogyakarta State University fashion education study program uses teaching and learning methods to foster knowledge about the environment, which allows analysis of related problems at the observed research location with the aim of finding solutions in the form of appropriate designs. With the increasing concern of the world community towards environmental issues, environmentally friendly design will become the main focus in every project carried out by professional designers(Alzaydi, 2024) (Muposhi & Chuchu, 2022). Therefore, students in the fashion design education study program who will become professionals in the industry, need a lot of opportunities and experience to consider environmental and climatic conditions in future urban planning and green space design work.

Textile technology courses that previously used conventional/lecture learning methods must be shifted to a practice-oriented learning approach to bring students closer to the environment (Lund & Cyvin, 2022). More focus should be placed on community needs and learning related to current environmental issues. The research presented in this article aims to foster student behavior to care about the environment by developing sustainable textile designs through project-based learning.

2 METHOD

Participants in this research were students taking textile technology courses, a fashion design education study program, at Yogyakarta State University. Project-based learning about eco-consciousness is applied to fabric-making and design skills. The sample in this research was 35 students taking textile technology courses. This learning takes place for 16 face-to-face meetings or 1 semester, minus 2 face-to-face meetings, namely for the Mid-Semester Exam and Final Semester Exam.

In this research, students observed textile manufacturing activities among batik craftsmen in the Yogyakarta area, then carried out a needs analysis and continued with the redesign. Students are expected to be able to identify the problems of batik craftsmen, analyze these problems, and find solutions in the form of batik reconstruction designs. The following are the stages of learning activities in this research using the PjBL approach.

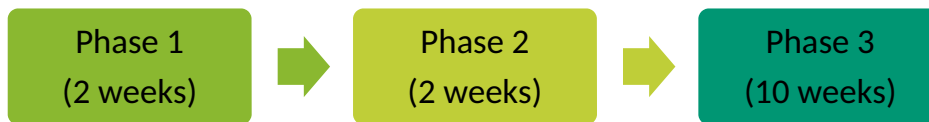


Figure 1. Phase of learning activities

Phase one lasts two weeks (eight class hours). At this stage, students are assigned to conduct surveys in the Yogyakarta, Bantul, Sleman, and Kulon Progo areas in January 2024. These areas are areas for batik craftsmen. The students' assignment goals for this survey included increasing their understanding of environmentally friendly and environmentally unfriendly craftsman behavior. Students are also assigned to carry out a physical review of the batik results because at the next stage they are expected to be able to redesign this batik. To facilitate activities, students were divided into seven groups, with five members in each group.

Phase two lasts two weeks (eight class hours). At this stage, students are asked to analyze design, color, and quality aspects. Students are asked to integrate their design ideas with knowledge related to the environment that has been obtained from field observations. The resulting design ideas are continued with drawing work in stage three. At this stage students need to consider the creativity, function, applicability, and standardization of the design, and whether their design can convey an environmentally friendly design philosophy to others.

The third stage lasts ten weeks (40 class hours). At this stage, students begin to draw/redesign the design. Design ideas are approved by the lecturer in charge of the course, and then developed into a product. The project in this course requires students to use environmentally friendly design methods in their fabric design, using natural dyes. After drawing the design, students turn the design into cloth by dyeing it with natural dyes.

Evaluation is carried out to assess student performance in the project stages. External practitioners who are experts are invited to evaluate the project results, together with lecturers and students. Evaluation is important to get feedback from tutors and peers, thereby encouraging students to improve their performance in the next stages of the project. Discussions between students and tutors can improve the understanding of professional knowledge in the process. It is hoped that the PjBL approach used in textile and housing technology classes will help increase environmental awareness.

3 RESULTS AND DISCUSSION

From the results of observations in the first week, it was found that batik craftsmen's behavior was not environmentally friendly, including the use of dangerous chemical dyes, disposal of liquid waste left over from dyeing, the composition of dyes that did not match the dyeing recipe, and excessive use of wax.



Figure 2. Results of Phase 1 Observations

The results of the observations were then used as a reference in redesigning the fabric with an environmentally friendly design concept. Below, several students in groups design textile designs that will be developed into products.

The design developed is then dyed using natural dyes. The dyeing process using natural dyes is as follows:

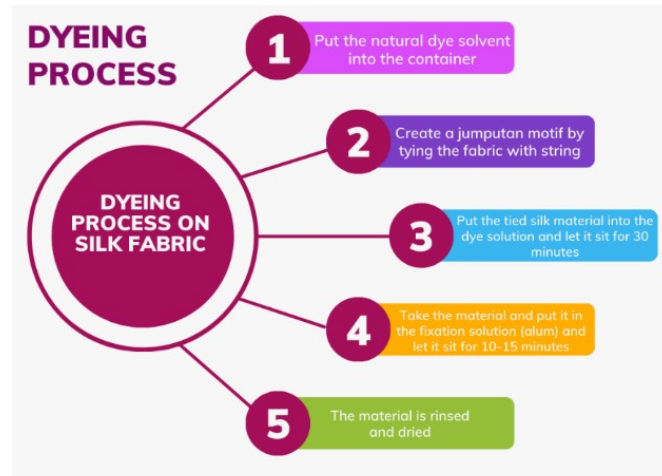


Figure 3. Dyeing Process

In one group, some students extracted natural dyes according to the recipe above and others mordanted the fabric to open the pores of the fabric so that the absorption of the dye was faster. The following is a recipe for extracting natural dyes:

Table 1. Natural Dye Extraction Recipe

Information	Quantity
Vlot	1: 10
Water needs	Vlot x weight of material $10 \times 215 \text{ gr} = 2150 \text{ ml} = 2.15 \text{ liters}$
Need for natural dyes	500 gr
Temperature	Boiling
Time	The volume of water becomes half of the initial volume

Table 2. Fixation Solution Recipe

Information	Quantity
Water needs	Vlot x weight of material $40 \times 215 \text{ gr} = 8600 \text{ ml} = 8.6 \text{ liters}$
Alum fixation	70 gr/liter

Dye extraction is carried out using the following procedure:



Figure 4. Natural Dye Extraction Process

In groups, students practice preparing natural dyes according to the recipe and carrying out mordanting. The following is student documentation when preparing fabric and dyes:



Figure 5. Students prepare fabric and dyes

From this documentation, it can be seen that the students are very enthusiastic. A fun and memorable learning atmosphere will attract students' interest to be actively involved so that learning objectives can be achieved optimally (Mitton & Murray-Orr, 2022). Fun learning can indirectly arouse students' desire to learn better and be motivated to be able to absorb more information and always try to continue their curiosity in the lessons they do in class (Chan et al., 2019; Lucardie, 2014). The hope is that through this project-based learning, students will increase awareness of the importance of developing environmentally friendly products.

In the third phase, students carry out immersion according to the design developed. Here students are given the freedom to be creative and innovate. Creativity is an inseparable part of the thinking of the campus academic community, especially students, where creativity is the ability to produce new things that have never existed before (Marnewick, 2023; Yu, 2024). The process of producing new things can come from the student's imaginative process, it can also come from previous information and experience regarding the thing to be created (Wu, 2024), then the student combines and updates existing work and ideas to produce new work or ideas, and different from previous works.



Figure 6. Students do immersion



Figure 7. Product Results

Students of the fashion design education study program are future fashion practitioners and must have a big influence on sustainable development (Zakaria et al., 2022). Therefore, extra efforts are needed to increase and deepen their awareness to protect the essence of sustainable development or eco-friendly design (Chen et al., 2024). Students with sufficient competence will have a sense of self-confidence and independence to build environmentally friendly businesses (Siqueira et al., 2023).

Education must be based on knowledge of natural sciences (Fang et al., 2024) to understand environmentally friendly textile design methods. In this case, students need continuous assistance (Saiyed, 2019), not only from the lecturer in charge of the course but also from industry experts. These practitioners are beneficial for education, considering that practitioners can transfer much more professional experience to students because they have previous experience (Rumayor et al., 2024) (Glackin & Phelan, 2020). Practitioners from companies or industries can provide environmentally friendly textile design methods and ideas and remind students of project implementation details from the perspective of real-life projects.

4 CONCLUSION

Based on the results and discussion above, several conclusions can be drawn as follows: 1) through the PjBL approach, students' teamwork skills are improved, and students can communicate ideas and discuss them among group members in solving problems and achieving project goals, namely developing environmentally friendly fabrics ; 2) implementation of PjBL

in textile technology courses fosters a caring attitude towards the environment through observation, analysis and design. The recommendation from this research is that after becoming professional textile designers or entrepreneurs, students will continue to adhere to the principle of always caring about environmental sustainability and will create environmentally friendly textile designs

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