



Seminar as a way to educate engineering students on environmental challenges in the textile industry

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ABSTRACT

The Ecole Nationale Supérieure des Arts et Industries Textiles (ENSAIT) is one of the few schools specialising in materials for the textile industry. Each year it graduates around 110 engineers whose role is to meet the challenges of the sector while respecting the values of the companies and environmental standards. The ENSAIT engineer's course takes place over three years. From the first year of the engineering

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cycle, a seminar on sustainable development is offered. It is held in the second semester and lasts two full days. The first objective is to make them aware of corporate social responsibility (CSR) issues in companies. The second is to build on the knowledge acquired during the last 6 months to develop the life cycle of a garment and understand the associated impacts. Finally, it is to highlight the different possible strategies based on eco-design, fair trade, taking into account the regulatory constraints. This seminar is based on active pedagogy, where students work in teams and compare their results with each other. It also aims to provide the minimum tools to understand ecodesign strategies and to be an informed fashion consumer, and to become a textile engineer capable of participating in and technically supporting companies' CSR initiatives.

1 INTRODUCTION

The Ecole Nationale Supérieure des Arts et Industries Textiles (ENSAIT) is a public institution of a scientific and professional nature located in the heart of Roubaix. It is one of the few schools specialised in materials and processes for the textile industry. Each year, it trains around 110 engineers whose role will be to meet the challenges of the sector while respecting the values of the companies and environmental standards.

The ENSAIT engineer's training lasts three years and is available either through a full-time study course or through a block-release program. In the first year, the courses include engineering sciences and the basics of textile processing. Specialisation is then progressive, first with a range of 'majors' offered in the second year (technical textiles; fashion and luxury) and then with a range of application areas in the third year (supply chain, connected business, composites, smart textiles, and sustainable materials and processes).

Also, given the social, ethical, environmental and economic issues raised by the textile industry, the training program provides for all engineers to be aware of and prepared to meet the needs of companies on these subjects. For this purpose, and for more than fifteen years, courses related to the various aspects of sustainable development have been given at ENSAIT. Initially proposed in lecture form and practical work, the educational reform of 2015 has enabled them to be divided between a seminar given in the first year and the specialisation offer of the majors and application areas proposed in the third year. Initially, the lectures were disseminated through the year. However, given the volume of time dedicated to sustainability, this approach was not constructive enough to enable students to develop a sufficient skill. Thus, the solution was to concentrate the dedicated lectures time into a single seminar event. Finally, the aim of such an organisation is to enable all students to become aware of sustainability issues and, for those who wish to specialise, to deepen methodological and critical thinking issues.

In the following, we will focus on the seminar, named "Sustainable development awareness seminar", and its pedagogical objectives, detail the programme (section 2) and go through its content (sections 3.1, 3.2, 3.3).

2 METHODOLOGY

2.1 Sustainable development awareness seminar

The Sustainable development awareness seminar is designed for about 90 students. It is held from the first year of the engineering cycle with the aim of raising awareness of corporate social responsibility (CSR) issues in companies.

By combining group and individual activities with expert presentations, the seminar aims to ensure that students:

- develop a critical mindset when faced with environmental claims,
- learn about the tools that are useful for addressing CSR issues (social audits, labels, environmental standards, environmental assessment methods),
- know how to understand, criticize and use the results of these tools,
- are fully aware of the regulatory and legal issues,
- understand the complexity of social issues and not making judgements.

2.2 Seminar structure

The seminar is held over 2 consecutive days and is awarded by 2 ECTS. To be awarded, students are evaluated on both, an individual basis and on a group activity:

- the individual evaluation consists in a quizz evaluation which cover the thematics addressed during the lectures and during the parallel workshops;
- the group activity assessment consists in a presentation of the work done during the self-directed activity which is further presented in section 3.3.

The seminar is mainly made of in class activities and is structured as follows:

- an introduction, given during the first half-day, provides a context for sustainable development with its many perspectives,
- learning the tools of CSR, carried out in groups over two half-days,
- a project to be carried out in groups and in autonomy during the last half-day.

In practice, it is as detailed in Table 1:

Table 1: Seminar structure

Duration	Content	Session type	Number of students
15 minutes	Academic introduction and program detail	Plenary session	90 students
45 minutes	Company's introduction about CSR	Plenary session	90 students
2 hours	Classroom lectures	Plenary session	90 students
1 hour	Exercices	Group sessions	45 students/group
4 * 1 hour and half	Parallel thematic Workshops	Group sessions	23 students/group
1 hour	Evaluation (quiz session)	Individually	90 students



Half a day	Self-directed activity	Group	6 to 8 students
From 20 to 45 minutes	Thematic interventions	Plenary sessions	90 students

In class activities This structure mixes lectures and active pedagogy. As discussed by Jouquan et al. [1], active pedagogy create the right conditions for students to engage and persist in learning situation. As mentioned by Jouquan et al. active pedagogy requires a high level of commitment from both, the students and lecturers. Thus, to engage students before the beginning of the seminar, a first out of class activity is committed. Students have to work in groups on the CSR policy of companies in the clothing sector. The companies are pre-selected to cover the field of possibilities: from mass market to luxury, including new brands "born from sustainable development values" (i.e. Bonobo, Burberry, C&A, Carrefour, Mudjeans, SKFK, ...). This activity, delivered in the form of a report, must be returned before the start of the seminar and is intended to provide an initial snapshot of the distance that students are able to stand back from the environmental claims made by companies. Such an exercise corresponds to a role-playing exercise that Lemaître mentioned [2]. The aim is to use observable practices from professional contexts into a training one. The training situation is as close as possible to a professional life situation, which should enable the student to project into a future activity. Such a learning situations supports meaning for the students, unlike courses centred on knowledge content seen as disembodied.

3 RESULTS

3.1 Seminar introduction

The beginning of the seminar is marked by an introduction which allows explaining the programme and most of all to set the scope of this course.

In the context of textiles, it highlights the variety of themes behind the term "sustainable development". As an illustration, professionals, consultants or companies are given the opportunity to present their views. The aim is to benefit from the experience of these players, to appreciate the existing dynamics and for the students to become aware of the expectations of the sector. Regarding these presentations, it is also interesting to notice that a more systematic use of video-conferencing has allowed more actors to intervene and therefore to cover more perspectives. As an example, during the 2020/2021 seminar, these presentations enabled both an approach to CSR, its meaning in companies (with the aim of showing the diversity of themes: social, societal, ethical, legal, environmental or even image) and to deal with specific topics, in this case the environmental labelling of textile clothing products (a topical subject that these engineers will be confronted with as soon as they leave school).

Alternating with these presentations, a first session of courses is held on eco-design, its principles and objectives, its tools and their advantages and limitations.

The aim of eco-design being to reduce the environmental impacts related to the life cycle of a product or a process, it is essential that the students understand these

impact indicators. To do so, the students are actively involved in a group exercise. Each group has 1 impact indicator to choose between a list of 16. As an example, they can investigate the global warming potential or the eutrophication or the ecotoxicity and so on. The time dedicated being 20 minutes, they have to understand describe and prepare 2 slides maximum for presenting to all the students. At this stage, it is not requested to make any link with the textile value chain but rather to describe the impact indicators used in LCA.

3.2 Evaluation tools

The following two half-days are dedicated to developing students' skills regarding the tools that will enable them to monitor and respond to the social, environmental and legal aspects of sustainable development with:

- an initial exercise to familiarise themselves with single-criteria quantitative tools for the energy and carbon footprint of a textile product, the exercise being individual,
- four successive workshops dealing specifically with (1) social impact assessment tools, (2) environmental labels, claims and obligations, (3) the legislative and legal aspects of sustainable development and (4) life cycle assessment.

3.2.1. Energy and carbon footprint assessment of a product

A first individual activity is proposed before starting the four workshops. For one hour, students are divided into two groups and are asked to draw the outlines of a first eco-design case study. At this stage, the product (a cotton shirt) is virtual and relatively simple. The idea is to give concrete form to some of the statements made in the first part.

In practice, the approach consists of conducting an energy and a carbon assessment of the life cycle of this shirt. Using their skills in textile processing, the students are responsible for determining the manufacturing cycle of the shirt and its use.

As these two evaluations are single-criteria assessments, this exercise is an initial awareness-raising exercise and introduces the interest of Life Cycle Assessment (LCA) as a multi-criteria tool.

3.2.2. Social impact assessment tools

After a first sensitization to the social problems of the textile industry, the students are given a definition and an illustration of what a social audit is. They thus become familiar with the objective of the tool and its possible uses. Indeed, it is a tool for evaluating the conformity of practices, and the outcomes are part of a wider diagnostic and continuous improvement process. They can be used to meet the requirements of standards, for example in relation to responsible purchasing.

The audit practice is explained by covering the audit criteria (management system, transparency and traceability, minimum age, forced labour, non-discrimination ...) as well as the role and behaviour of the auditor.



A case study is included in this workshop. It gives the students the opportunity to experience a situation where they have to map the "supplier risks" on social impact maturity. The approach is to be validated by the construction of a rating scale and an example of a questionnaire to cover part of the audit criteria outlined earlier.

3.2.3. Environmental labels, claims and obligations

Standards and labels are abundant in the textile sector. They enable buyers to be informed about the environmental and/or social performance of a product or service. Thus, they are widely used. However, it is not easy to distinguish between a promising logo and the reality of the specifications.

To this end, this workshop enables students to:

- understand the principles of environmental communication and thus be able to better assess the transparency, relevance, credibility and clarity of a given communication
- to know the communication methodologies, specifically the categories of declarations developed in the ISO 14024 standard.

An additional exercise is to investigate and report on different labels. This teamwork should enable students to investigate the governance and the origin of the label, its objectives, the certification criteria and their link with the textile sector.

Attention is also paid to the REACH directive, which aims to regulate the use of chemical substances in Europe. As the list of substances is constantly being updated, it is crucial for students to be aware of it and to know how to find and relay such information.

3.2.4. Legal contribution to the sustainable development seminar

During this workshop, students are introduced to the legal instruments that support CSR. Indeed, CSR is framed by a number of national, European and international standards.

While the previous workshop (Environmental labels, claims and obligations) focused on voluntary labels and standards, this workshop focuses more on mandatory standards and the legal consequences of non-compliance.

Thus, binding tools such as the Commercial Code, the OECD principles, children's rights, the law on duty of care, the REACH regulation, the anti-waste law for a circular economy (AGEC) etc. are presented. This latter is also covered in an exercise to better understand the obligations of companies with regard to the regulation and what the penalties are in case of non-compliance.

In addition, the restrictive nature of the various legislative measures is illustrated with various case studies from forced labour to misleading advertisements to the non-respect of the right to strike in the textile value chain.

3.2.5. Environmental assessment tool: Life Cycle Assessment (LCA)

The last workshop focuses on life cycle assessment, a multi-criteria quantitative environmental assessment tool.

The aim is to enable students to grasp the LCA methodology, its vocabulary and what it requires.

The approach is similar to this presented by Viere et al. [3]. The teaching starts with an introduction and the positioning of LCA in a wider context. It is followed by an explanation of the principle, purposes and steps of LCA, regarding the ISO 14040 and ISO 14044. It is followed by the use of the simplified LCA software, EIME proposed by CODDE Bureau Veritas. This online tool corresponds to the students' area of study and benefits from textile-specific databases. Practice is carried out individually on a common case study, the cotton shirt mentioned above, whose life cycle has been determined. The purpose of this exercise is to enable students to identify the "hot spots" in the life cycle of a garment, to be able to monitor future design choices and to understand the concept of life cycle thinking.

3.3 Ecodesign - Self-directed project

The final phase of the seminar is devoted to a student-led project. Entitled "CSR and eco-design strategies", it allows students to put into practice the tools they developed during the seminar. In groups of 6 to 8 students, they are asked to represent the same company whose main product is a cotton shirt, produced in a globalized manner. The company's objective is to improve its CSR strategy, particularly in terms of environmental and social issues. The statement is given as a problem situation more than an exercise. As mentioned by Fayolle et al. [4], it enables to provide a more open but also more realistic context for empowerment and reflection.

An eco-design wheel and guiding questions are provided to assist students. They are expected to choose improvement strategies and to describe how they will implement, monitor and control the success of the strategy.

This experience is punctuated by thematic interventions given by professionals, consultants or companies. The themes covered include end-of-life textile management, the circular economy and the economy of functionality. They are proposed in short formats, 20 minutes long, and should stimulate reflection in the framework of the self-led project.

4 REFLEXIVE FEEDBACK

As previously mentioned, the current seminar format aims to replace previous lectures which were disseminated through the year. This previous approach was not constructive enough to enable students to develop a sufficient skill. Given the volume of time dedicated to sustainability, this approach required constant revisiting of course material as a reminder. By concentrating the sustainability related lectures in two consecutive days, the seminar approach enabled us to better engage students in an intensive learning process and to add some active pedagogy practices. However, by working over two consecutive days, we are experiencing the advantages and disadvantages of such an approach. It is quite clear that the concentration of topics and content is high and it requires a quick involvement of students. However, as some students will not pursue a specialization in sustainability, it is an opportunity for them



to deal with diversified topics. It also enable them to increase their critical mindset from regulatory aspects to environmental and social assessment methodologies and communication. As future engineers, whether specialised or not, it is essential they gather knowledges so that they can think constructively about the issues of sustainability.

As lecturers, the preparation workload is quite similar to the one required for traditional lectures. The additional steps are spent on organising and on meeting with companies, specific organisms and NGO to get them involved. It appears that these external interventions are particularly appreciated by students and require our full attention.

During the seminar, we also have:

- To play as a time keeper. The agenda of the seminar is full of activities, some of which may run over. Thus, in order to tackle the whole of the planned programme, it is important to be careful with time management.
- To deal with a diversity of students profiles. The students arriving at ENSAIT come from relatively varied backgrounds and for this reason, the skills are relatively heterogeneous. Facing new activity and knowledges, this diversity of profile is remarkable and requires adaptation and, as far as possible, individualisation.

As mentioned above, the students work individually or in sub-groups. So far, the students groups were made relatively to an other project. Since the students well know each other, we noticed different dynamic nature of each group. At the moment, it is up to us to compensate the weakest dynamic going from group to group. There is probably a way to make it more efficient, perhaps by assigning roles to the students or by setting a time for exchange per group.

This seminar format is led for more than five years. After each, a survey is conducted to know more about the students opinion. It appears that the satisfaction level is quite high with more than 75% of satisfied students. Compared to a traditional lecture, students highlight the changes in the rhythm of each activity, the interactivity and the group activity, the self-directed one specifically. Regarding students opinion, the strongest elements of this seminar are:

- The involvements of companies and association;
- The diversity of intervention methods.

Regarding students' opinion, the areas of improvement are about the time, more time should be spent on the topic in general and on the different activities. This would help them to better appropriate the tools. The imposed nature of the groups was also discussed. Indeed, group work remains a challenge and it is sometimes difficult to involve 6 to 8 students in the same activity. The activity we are proposing is no exception and students would like to be grouped by affinity. This is a choice that we



have already experienced with in other situations and which also has its drawbacks (group harmony, heterogeneity of skills, etc.)

5 SUMMARY AND ACKNOWLEDGMENTS

In order to address the sustainable development issues of the textile-apparel sector, a sustainable development awareness seminar is provided in the first year of the ENSAIT engineering course. This seminar covers more than just environmental aspects, it also introduces social issues and social impact assessment tool, environmental labels and communications, vigilance towards claims as well as legal aspects behind sustainability. Students are frequently put into active situations, either individually or in groups, in order to better understand the tools, their implementation and their limits. This format enables a positive group dynamic which is supported by strong individual motivations.

Students learn to step back from sustainable development issues, and sharpen their critical eye. They become aware of how the textile industry is involved in sustainable development actions, and that they have a crucial role to play in transforming the textile industry.

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