Workshop on “Interactive Displays: Use, Benefits, Environmental and Social Impacts”

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Abstract— This innovative practice full paper describes, a workshop that arose from the growing environmental awareness of our students and the observation that the responses proposed by engineering schools were still limited. The integration of environmental and societal impacts of technology into our courses is not sufficiently addressed. The aim of the workshop was to develop students' critical thinking skills, raise their awareness of the environmental and societal impacts of digital technology, introduce them to industry and give them the opportunity to work in multidisciplinary, culturally diverse teams. The workshop "Interactive Screens: usage, usefulness, environmental and social impacts" was held on February 6 and 7 and brought together 74 students from various engineering schools and one business school. Ten experts were in charge of helping the students to prepare the work according to industrial concerns; these experts came from industry (researchers for private companies, managers) and from the academic world (professors, public researchers). The experts helped the organizing team to gather scientific resources and one of them presented his work on the rebound effect. The workshops themselves lasted two days and were conducted entirely in English. The students were divided into 13 groups of 6 and worked in different application areas (education, business, entertainment).

Keywords— Microelectronics, Sustainability, Innovative Pedagogy, Creativity, Teamwork

I. WORKSHOP DESIGN AND IMPLEMENTATION

A. Context

In February 2024, the second edition of the "Kaleidoscope Week" took place, bringing together several engineering schools. The goal of this mandatory week is to bring together students from different backgrounds. The previous year, an extensive study of engineering students' interests in microelectronics had shown that students wanted to learn more about sustainability in microelectronics. This recurring two-day workshop was developed at the request of a consortium of academic and industrial partners in microelectronics. This year's topic was "Use, Benefits, Environmental and Social Impacts of Interactive Displays".

The participants were students in their second year or Master 1 engineering students coming from several engineering schools and one business school. Due to their different nationalities, the workshop was conducted in English.

The goal of the workshop was to develop students' critical thinking skills, raise their awareness of the environmental and societal implications of digital technology, introduce them to industry, and get them to work in multidisciplinary, culturally diverse teams.

B. Organization

The organization of the whole workshop (logistics, time management, animation...) was managed by a team of instructional designers. They consulted industrial and academic researchers to select the workshop topic according to the industry's needs. Since the goal of the workshop was to practice a scientific methodology, the instructional designers collected scientific resources to build a corpus [1] [2] [3] [4] as examples. To ensure that the resources were relevant, the instructional designers implemented a selection process with the following criteria: year of publication, reliability of the source, and relevance to the topic. In some cases, they pre-selected excerpts for long resources such as dissertations.

C. Agenda

On the first day, the students attended presentations on the different types of interactive displays depending on their use: educational, corporate or entertainment. Then an industrial researcher presented the rebound effect in the development of the microelectronics industry. The aim of this second presentation was to make the students aware of this aspect and to encourage them to behave as future professionals working in the production or sale of electronic devices.

The students were divided into smaller groups and they had to read resources (press, scientific articles and videos) in order to discuss the different uses and benefits of interactive displays in the academic, corporate or entertainment fields.

For each group, 3 students had to read the resources in favor of the development of interactive displays (e.g., fast exchange of information, participative meetings, lower energy consumption compared to video projectors, image quality, stimulation of creativity...). The other 3 had to read the resources against the development of interactive screens (e.g., rebound effect, impact on the environment, visual fatigue, less real interaction...). Then, in turn, they summarized what they had read for the other members of the group. In this way, everyone had the same level of information. They then discussed the pros and the cons of interactive screens and the rebound effects of digital technology. Using all the

information they had gathered during the day, they had to come up with innovative ideas to limit the environmental and social impact of interactive screens.

On the second day, they developed one of their ideas and prepared their pitch to present to the judges. Coaches were also on hand to answer questions and provide guidance. At the end of the second day, each group presented their idea-solution in plenary and a panel of judges evaluated the students' work after their oral presentation using a scoring grid.

D. Detailed Agenda for Day 1 - February 6th

At the beginning of the workshop, to familiarize themselves with the topic, each group worked through the provided resources on the following application areas: Education; Entertainment (including Hospitality & Retail); Corporate.

a) Browsing resources:

Each member of the group reviewed their resources individually. Some read resources in favor of interactive screens (i.e., they were part of the PRO trio) and some read resources against interactive screens (i.e., they were part of the CON trio). Within the trio, no one had the same bibliography.

b) Trio sharing & debate:

Students shared with their trio a summary of the resources they had analyzed. They also added their personal contributions and/or key findings from the Internet and debated and shared during the next period. The PRO trio argued in favor of interactive displays. They showed their opponents that interactive screens meet needs, are useful, and add value. The CON trio argued against interactive displays. They showed that interactive screens have disadvantages, especially in terms of environmental impact, and should not be used on a large scale. The students then shared their real opinions. They asked themselves: Am I for or against interactive displays?

c) Whiteboard summary & brainstorming:

Students made a summary of the advantages and disadvantages of interactive screens. They used a whiteboard to make it more visual or used the post-it and colored markers. They brainstormed ideas to reduce the environmental and societal impact of interactive screens in the application area concerned and within the group and voted for their favorite idea (each member of the group voted for 2 ideas). They had to think at a systemic level (government, companies, customers, end-users, suppliers, workers, engineers...) and about the whole life cycle of the screens (from raw materials to end-of-life). We advised them to look at eco-design and circular economy approaches, [1],[2]

E. Detailed Agenda for Day 2 - February 7th

During this phase, each group worked on developing their preferred idea.

a) Idea development:

To develop their idea, they had to think about how to implement this idea, who should be involved, what benefits this idea will bring, etc. To help them tackle the problem as a whole, they were advised to answer the question WWHWWWHM (what, why, how, who, where, when, how much).

b) Pitch preparation:

To prepare the pitch for the final presentation, they used the following structure: summary of use, advantages and disadvantages of interactive screens in the given application domain, idea pitch (what is the idea about, why this idea, how can this idea be implemented...).

F. Evaluation Criteria

To evaluate the students' oral presentations, the jury used an evaluation grid with the following criteria:

- Originality/innovation: Is the idea original? Innovative? Novel?
- Relevance: Does the idea make sense? Will it help limit environmental/social impacts?
- Feasibility: Is the idea feasible? Can it be implemented?
- Communication: Was the oral presentation good? clear? balanced?

II. Objectives and Benefits of the Event

The main objectives and contributions of this workshop were:

- Stimulate collaborative innovation by developing the individual and collective competence dynamics of young talents (future engineers and/or managers) with the help of industrial and academic experts, especially at the interface between applications and markets;
- Encourage the emergence of new innovation behaviors and practices, with a particular focus on agility, collaboration, entrepreneurship and sustainable impact;
- Develop new experiential learning methods (immersion, experimentation, interdisciplinary and intergenerational collaboration);
- Initiate learning communities as a powerful lever for engagement in sustainable development and civic responsibility;
- Make learning meaningful in the context of the societal and environmental issues students face today as citizens and tomorrow as professionals;
- Enable students to express their voices creatively and persuasively.

Cooperation and communication, as well as the ability to make decisions, understand a problem and hypothesize solutions, were developed through scenarios and questions that all the students worked on together. In addition, the creation of a database of supporting documents for this workshop facilitated the students' access to relevant information for the proposed activities.

[1] https://www.digitaleurope.org/projects/digital-product-passport/

[2] https://commission.europa.eu/energy-climate-change-environment/standards-tools-and-labels/products-labelling-rules-and-requirements/energy-label-and-ecodesign/energy-efficient-products/electronic-displays-including-televisions_en

III. STUDENT'S PRODUCTION

The students actively participated in the workshop and prepared professional presentations to present their idea to the jury. The winning team worked on the interactive screens applied to the educational domain. They first introduced the members of their team. Then they presented the state of the art of interactive displays, highlighting the advantages and disadvantages. For example, they mentioned distance learning with real-time feedback and analysis capabilities as advantages. As for the disadvantages, they talked about the acceptance of these screens by teachers, the maintenance required, and the CO_2 emissions in production and use. They then presented their solution, which was to develop infrared touch sensors that would reduce costs and increase accessibility. They supported their proposal with key facts and figures about their product's lifecycle, cost, accuracy, features, etc. Finally, they assessed the potential rebound effects and the social and environmental impact of their solution. According to the jury, this idea could be developed in collaboration with a French microelectronics industry.

IV. NOVELTY AND IMPACT OF THE WORKSHOP

A. A well-structured workshop

The novelty of the workshop lies in the fact that it is organized in several stages: first, a period close to the work of a researcher, followed by a period of brainstorming, the development of an idea and then the presentation of the results [5], [6]. This multidisciplinary approach allowed the students to understand researchers, business and industrial concerns. The workshop was organized in 5 steps:

- A time for research reading scientific and press articles
- A time for discussion critical thinking
- A brainstorming time to develop their creativity
- A time for idea development to improve their awareness of technical and business concerns
- A presentation time to experts to develop their ability to present the group's work.

In addition, the theme of the event addressed a current challenge regarding the environmental and societal impact of digital technology, more specifically sustainable microelectronics [7], [8].

B. The role of experts as an innovative way of working with students

Ten experts were responsible for helping the students to produce work that was as close to industry as possible; these experts came from industry (researchers for private companies, managers) or from academia (professors, public researchers).

During the two-day workshop, they helped the students to structure their thinking on the use and usefulness of interactive displays and to find new ways to reduce their environmental and social impact. They also had the task of helping the students with the technical aspects.

C. Collaboration between future engineers and managers

Another innovative practice of this workshop was that students from several engineering schools and a business school were mixed in the groups to find new solutions to a current technological topic. Fifteen nationalities were represented. Both the experts and the students appreciated this opportunity to confront cultures, viewpoints and academic backgrounds. One of the experts mentioned this as the main quality of the workshop.

- This workshop was an excellent opportunity for the students to train their ability to work in an international context (the whole workshop was in English) with different cultures.
- When designing the workshop, we wanted to include an activity that would interest students from engineering and business schools. It could not be too technical.
- They developed their critical thinking and their ability to summarize scientific articles in a short time and then their ability to discuss interactive screens: what are the advantages and disadvantages for an educational, business or entertainment use?
- The presentation of the rebound effect helped them to consider the impact of new technologies in their production or use. Innovation requires a systemic approach: What are the social and environmental impacts of the innovation? How can we reduce them?
- With 62% of the students saying that they will change their practice or mindset as future professionals (Fig. 1.), we can afford to say that the workshop succeeded in raising awareness of systemic thinking when working with new technologies.

D. Train the trainers:

Reading the resources and sharing their summary with other students is a way to make students more responsible in their knowledge acquisition. This is a way of working that they can use in their future work as an efficient collaborative way of working [9].

E. Evaluation of the workshop by the participants

The spirit of cooperation and multidisciplinary teamwork, the confrontation and reflection on issues and challenges close to industrial and social reality, all contributed to the success of the event. When asked about their overall satisfaction 15% of the students were very satisfied and 54% of them were satisfied.

The critical assessment of this experience was based on two different evaluations: (i) the students' point of view, obtained through a survey carried out after the two sessions. (ii) the point of view of the professors and experts who supervised and supported the students. This completely anonymous survey consisted of 17 questions (closed and open) and was sent to the participants immediately after the presentations and before the award ceremony. This allowed for more responses compared to last year's workshop, where the survey was sent a week later and received fewer responses. 85% of the students responded to the survey.

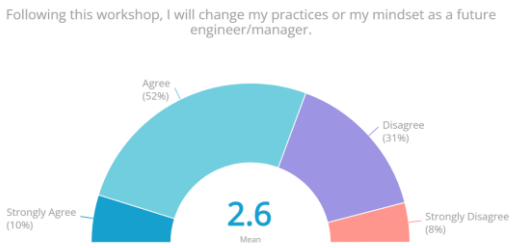

Fig. 1. Student survey results excerpt

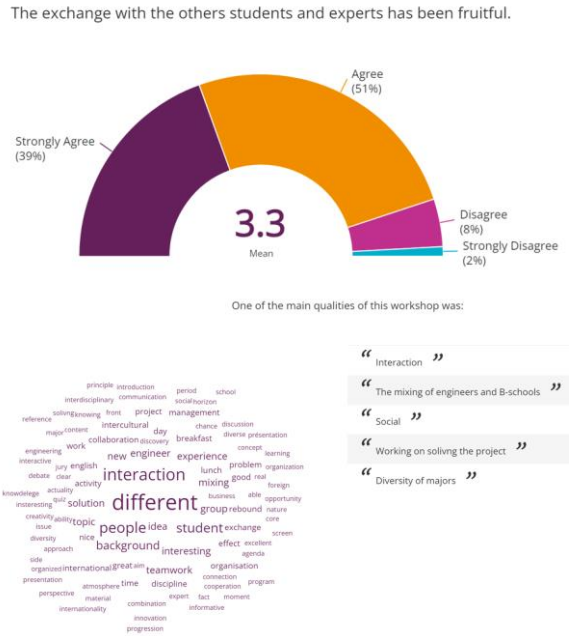

Fig. 2. Student satisfaction survey responses

The almost unanimous response of the students to the opportunity to express themselves freely, to exchange ideas and to seek creative solutions within the team, with other teams and with experts, confirms their appreciation of this workshop as a pedagogical activity that allows them to develop a variety of soft skills in a field that represents one of the major challenges of our time: the environmental and societal impact of digital technology.

V. Conclusions

The workshop "Interactive Displays: Use, Benefits, Environmental and Social Impacts" was designed to introduce students to the environmental and social challenges of responsible technologies. These issues proved to be a motivating and unifying theme for the young people. The workshop stimulated their curiosity and introduced them to a new approach that encourages them to think for themselves and work together to develop eco-innovative ideas.

The students realized that working together, both among themselves and with different partners in the sector, makes it easier for them to come up with solutions that are not just technical, but much more systemic. Many challenges can be addressed, such as supply chain and manufacturing management, ethical extraction of raw materials, energy use and consumption, repairability, recycling and obsolescence.

This type of activity brings something concrete to the movement towards technological change, as students have the opportunity to interact with experts who are working to bring about this change. Thinking about an application such as interactive displays, which today combine and offer the advantages of PCs, tablets and whiteboards, with the addition of interactive and collaborative functions, undoubtedly triggered concrete reflections that we hope will inspire future vocations.

This workshop could be improved in several ways:

- Propose a real business case study to the students and then allow them to develop their idea in collaboration with the company,
- Conduct a survey before the event to assess students' attitudes toward societal and environmental issues,
- Conduct a survey several months after the event to assess the long-term impact of the workshop.

This educational initiative is easily scalable to other technology topics, such as smartphones, or contexts, such as AI and ethical, sustainable IT.

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