Sustainable development as a driver of innovation

The main goal of the Human Capital and Learning Design program is to provide an agile and proactive response to the skills needs of the consortium's partners, directly related to R&D, technological dissemination and innovation activities.

SYLVIE BLANCO, SENIOR PROFESSOR OF TECHNOLOGY AND INNOVATION MANAGEMENT AT GRENOBLE ECOLE DE MANAGEMENT (GRENOBLE GRADUATE SCHOLL OF BUSINESS), CO-DIRECTOR OF THE NANOELEC/HUMAN CAPITAL & TRAINING DESIGN PROGRAM

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PANAGIOTA MORFOULI, PROFESSOR AT GRENOBLE INP-UGA, CO-DIRECTOR OF THE NANOELEC/HUMAN CAPITAL & TRAINING DESIGN PROGRAM

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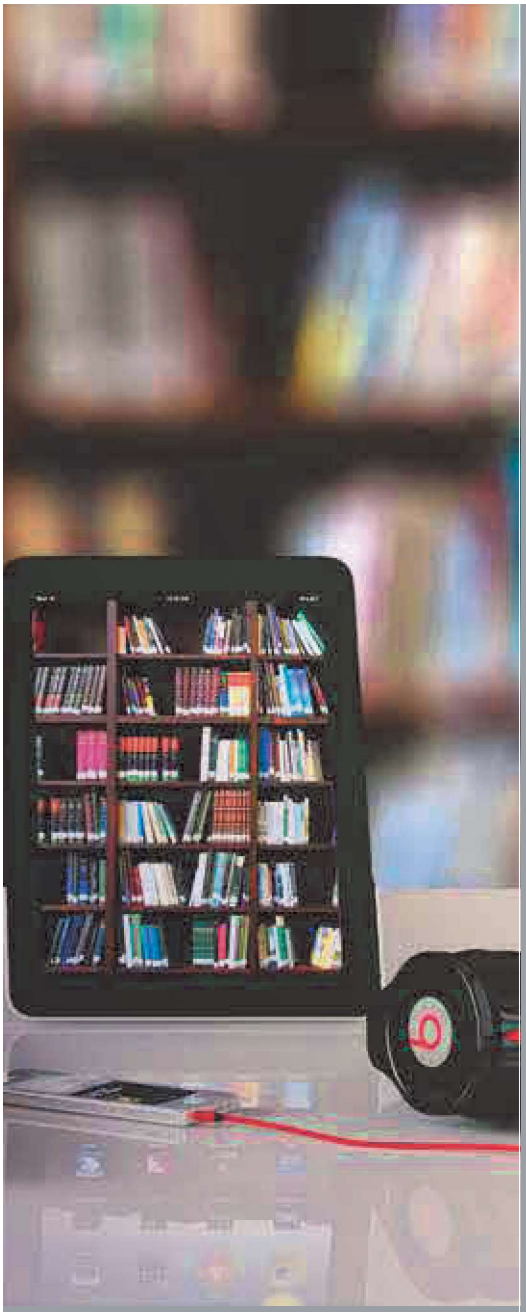
This program lies at the heart of the Nanoelec ecosystem, whose skills requirements stand out in their intensely technological nature, wide diversity of applications and firm commitment to a sustainable impact.

In 2024, 42 modules were designed and/or adapted, including 34 for initial training (level Bac+5 years) and 7 for continuing education. These developments led to effective deployment throughout the year, representing a total of 9,202 participant days. •••

AGENDA



To illustrate the innovative nature of the program and its commitment to sustainable development, a number of actions are highlighted: two tools to raise awareness of the challenges of a responsible digital world, a workshop dedicated to the societal and environmental impacts of interactive screens and the rebound effect, as well as a gamification approach aimed at making technological communication more accessible to the general public. •

CHIF PROGRAM AT A GLANCE

→ **Vision**
Enhancing the competitiveness of the electronics industry requires strong interdisciplinary collaboration, agile teamwork, and the continuous development of dynamic knowledge and skills

→ **Ambition**
Design and pilot an integrated, flexible, and tailored learning ecosystem that reinforces human capital and boosts the innovation capabilities of the Institute and its partners

→ **Mission**
Develop and deliver innovative training content and formats across three key dimensions: core competencies, experiential learning, and learning communities — all geared toward addressing emerging societal and technological challenges

→ **Partners**
Grenoble INP-UGA, Grenoble Ecole de Management (GEM), STMicroelectronics, Schneider Electric

Interactive Screens and the Rebound Effect

Over seventy students from Grenoble INP-UGA and Grenoble École de Management explored the environmental and societal impacts of interactive screens, with a particular focus on the “rebound effect” associated with the widespread adoption of new technologies.

In February 2024, the annual edition of the Chif program’s “Sustainable Electronics” workshop brought together experts from CEA, STMicroelectronics, Aledia, Pyxalis and the G-Scop laboratory, and students from Grenoble INP-UGA/Phelma and Grenoble École de Management.

“This year, students worked on the topic of interactive screens and the rebound effect,” explains Sylvain Engels, Professor at Grenoble INP-UGA and Digital Team Manager at STMicroelectronics.
“The focus was placed on large-format interactive screens such as whiteboards, information kiosks and control terminals,” adds Laura Mazzarella, Nanoelec/Chif pedagogical engineer at Grenoble INP-UGA/Phelma, who co-designed the workshop with Estelle Belin di Stephano, also a pedagogical engineer. *“Interactive screens are now ubiquitous: smartphones, tablets and more. Students were asked to reflect on the environmental and societal impact of these devices, and to analyze how the rebound effect might offset the intended sustainability gains.”* •••

The rebound effect refers to the unintended consequences where improvements in energy efficiency lead to increased overall consumption, ultimately reducing or even negating the expected environmental benefits.

"Improving energy efficiency doesn't automatically translate into reduced energy consumption," explained Bruno Gayral, researcher at CEA who introduced the workshop. *"In fact, global energy use has surged in recent decades despite major advances in efficiency. Take LED technology, for instance: while more sustainable and efficient, it has enabled new applications — from hydroponics and indoor farming to architectural lighting and a proliferation of screens — that have ultimately increased overall energy demand."*

During the workshop, students were divided into 13 groups of 5 to 6 participants, with each group assigned to a specific application domain such as education, entertainment or business.
After analyzing literature outlining both the benefits and drawbacks of interactive screens, each group was tasked with designing and presenting solutions aimed at reducing their environmental and societal impacts — while explicitly factoring in the rebound effect. *"What stood out to me was the students' enthusiasm and the relevance of their proposals,"* noted Sylvain Engels. *"The quality of the presentations they delivered - in under 24 hours - was remarkable. One group has even expressed a desire to pursue their concept further, and I fully intend to follow their progress."*

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PROFESSIONALS AND STUDENTS COLLABORATED TO TACKLE THE CHALLENGE OF SUSTAINABLE ELECTRONICS DURING THE 'INTERACTIVE SCREENS AND REBOUND EFFECT' WORKSHOP ORGANIZED BY CHIF IN FEBRUARY 2024

A student group working on the attractiveness of the microelectronics sector in Grenoble INP-UGA/Phelma

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The Addvisia platform adapted to a campaign for a commercial brand

From concept to prototype, the Red Bull Clash fictitious experiment shows how gamification, technology and brand can come together to create impactful interactions with the consumers.

The Gesturama pedagogical gamification exercise, developed by Nanoelec/Chif to promote the Nanoelec/Addvisia platform at the Tech&Fest 2025 festival goes beyond just digital design. The students from *Grenoble École de Management* built a complete arcade stand incorporating TOF (Time-of-Flight) sensors from ST-Microelectronics to detect the players' movements in real-time. They cooperated with Didier Chabanol from the IVèS company to understand communication through gestures, as well as markets and trends. They did the coding work with Fanny Aubry from the CEA/Y.Spot design team. The game transforms Red Bull's iconic symbols into an interactive brand experience. It uses gesture recognition technology to create immersive engagement for the customers. It promotes a strong community culture through ritualistic movements.

Raising awareness for a responsible digital world

Starting from a project designed at the Ense3-G INP school to determine the carbon footprint of digital usages in the school, two awareness-raising tools were created within Nanoelec/Chif.

"The aim is to enable a wider audience to acquire knowledge of the socio-environmental issues of digital applications, encourage them to take a fresh look at their practices and usages, in order to adopt a more responsible approach," explains Loane Danes, pedagogical engineer and "Sustainable Development & Societal responsibility" coordinator at Grenoble INP – Ense³, UGA. This project, which was initially designed to assess the carbon footprint of digital usages at the Ense³ school, was expanded and implemented in two pedagogical tools within Nanoelec/Chif.

The project was presented at the 2024 symposium for sustainable electronics and digital applications in Grenoble[1] and also during a Nanoelec webinar intended for the French electronics community in February 2025[2].
In the "Digital escape" game, the participants take part in an adventure where they discover the lifecycle of a smartphone and the corresponding impacts, while solving puzzles. The "Digital Odyssey" workshop, which lasts about two hours, asks the participants to think about the material nature of the digital world, its impacts at each step along the lifecycle, and its role in the societal and environmental transition[3].

USING A SERIOUS GAME IN A WORKSHOP TO PROMOTE EFFECTIVE HYBRIDIZATION STRATEGIES AND ENHANCE ENVIRONMENTAL AWARENESS

1. Danes, L., Morfouli, P., Mazzarella, L., Rouge, M., & Le Rasle, C. (December 12, 2024). Digital Escape and the Digital Odyssey: Two tools to raise awareness of the issues of a responsible digital world [Poster]. Symposium for sustainable electronics and digital applications, Grenoble

2. https://irtnanoelec.fr/actualites/webinaire-ingenierie-pedagogique-pour-le-numerique-responsable/

3. The English version is also available for the partners in the European GreenChips project, which include Nanoelec

Hybridizing profiles on the impact of interactive displays

A paper presented at the “Frontiers in Education FIE 2024” conference, in the "innovative practice" category, describes a workshop that emerged from students’ increasing environmental awareness.

The environmental and societal impacts of technology are not sufficiently integrated into students' curricula. In an innovative Nanoelec/Chif workshop, 74 students, with profiles ranging from engineering to business, were brought together with ten experts (including researchers from private companies, managers, and academics). *“This type of activity provides tangible support for the movement towards technological change, as students have the opportunity to engage with experts actively working to drive that change. By exploring applications like interactive displays, which combine the functionalities of PCs, tablets and whiteboards with interactive and collaborative features, we triggered meaningful discussions that we hope will inspire future careers,”* explains Estelle Belin Di Stephano, training engineer at Nanoelec/Chif as a first author of the paper[4].

Emerging pedagogical methods

Hélène Michel, a professor at GEM and sponsor of the Gesturama project within Nanoelec/Chif, explores the contributions of new pedagogical approaches.

How are serious games transforming research?

H.M. One of the most innovative roles of serious games could lie not in the dissemination of messages, but in the creation and collection of new information or knowledge, by using the game in the same way as a research laboratory[5]. By gaming with the students, the lecturer-researcher becomes an agent provocateur who influences the dynamics being studied, revealing behaviors that would otherwise be inaccessible via traditional methods, Serious games are transforming research, encouraging more creative and engaged exploration of the social phenomena.

Design fiction prototypes the future

H.M. Increasing numbers of companies are hiring design fiction scriptwriters and designers. This is an immersive method which uses science-fiction to project potential futures. In our design fiction classes, the students write and record stories about an everyday moment as it could be some time in the future. Thus, on the topic: “A day in the life of a Grenoble student in 2050”, questions regarding the integration of technologies, in particular those arising out of Nanoelec, the possible future of Alpine ski resorts and all the subjects previously worked on with the ecosystem of partners, are covered in a radio news broadcast of the future.

What do your students do?

H.M. In the same way as scriptwriters, they imagine how technologies and societal trends could change. For example, what would happen if we understood the language of dolphins? If robots went on strike?[6] In the process as developed, the students must embody this future everyday moment via an artifact. They therefore prototype an object of the future in fab lab type locations.

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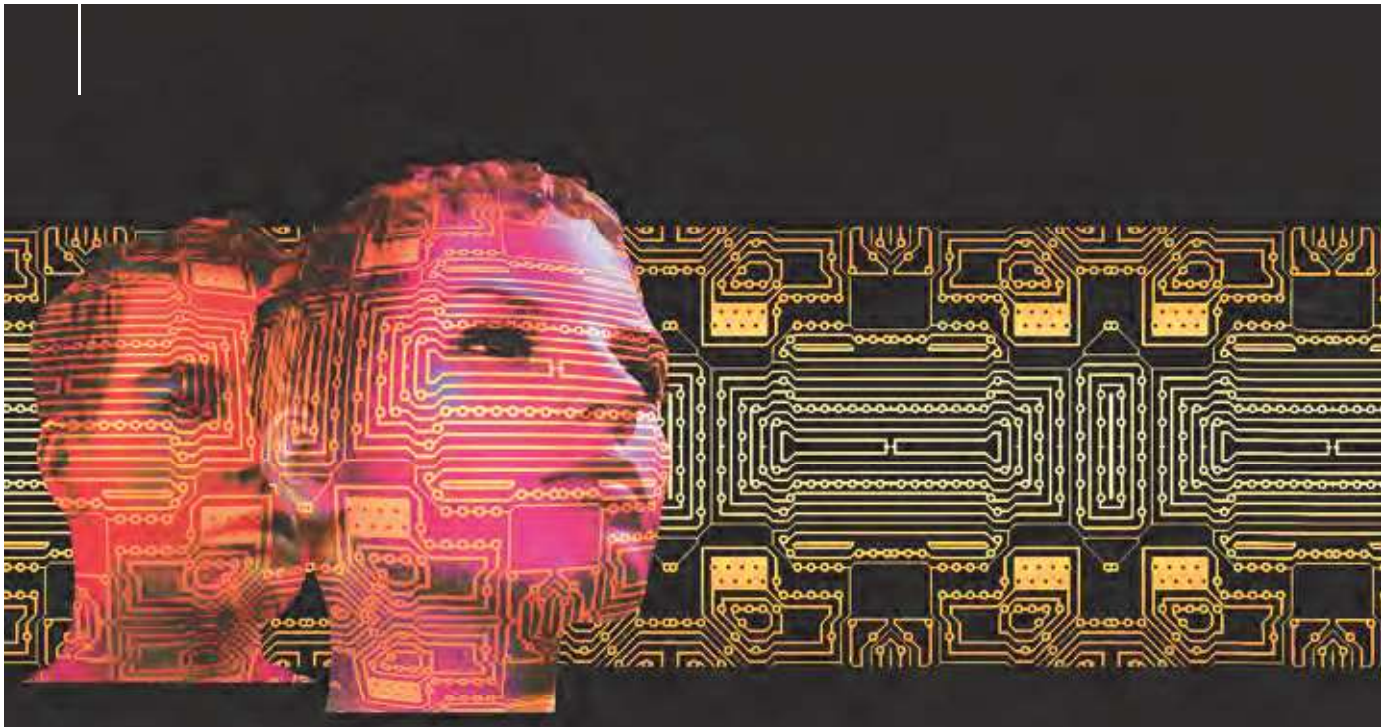
4. Belin-Di Stephano, E., Morfouli, P., Mazzarella, L., & Le Rasle, C. (October 13, 2024). Workshop on “Interactive Displays: Use, Benefits, Environmental and Social Impacts”. Frontiers in Education FIE 2024, Washington DC, USA.

5. Hélène Michel, Z. S. (May 31, 2024). Serious games as a provocative research method? [Journal]. https://www.openscience.fr; OpenScience : OUI.

6. Michel, H., & Blanco, S. (September 22, 2024). Training students to imagine possible futures through design fiction. The Conversation. http://theconversation.com/avec-le-design-fiction-former-les-etudiants-a-imaginer-les-futurs-230317



Increasingly involved in embedded artificial intelligence

Artificial intelligence (AI) expertise is increasingly important in order to differentiate products developed specifically for applications.