International Conference

Co Creation Processes in Higher Education

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Esta publicação reúne os resumos das comunicações apresentadas na Conferência Internacional em Processos de Cocriação no Ensino Superior (In2Cop) 2025 e inclui ainda o programa do Encontro.
As doutrinas expressas em cada um dos resumos são da inteira responsabilidade dos autores.
This publication presents the abstracts of the communications presented at the International Conference in Co-Creation Processes in Higher Education (In2Cop) 2025 and the program of the Meeting.
The opinions expressed in each of the abstracts are the sole responsibility of the authors.

PRR Plano de Recuperação e Resiliência
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PREÂMBULO

Instituto Politécnico de Bragança, na terceira edição do In2CoP, sob o título "Conferência sobre Cooperação Internacional no Ensino Superior – Cocriação Multicultural para Sociedades do Futuro", apostou este ano na cocriação multicultural para desenvolver competências para as sociedades do futuro, nomeadamente competências empreendedoras e criativas enriquecidas por perspetivas transculturais.

A conferência teve duração de quatro dias:

Dia 1 (28 de janeiro) com a cerimónia oficial de comemoração do Dia do IPB, com a presença do Ministro da Educação, Ciência e Inovação.
O segundo dia (29 de janeiro) concentrou-se na cooperação internacional no âmbito das Alianças Universitárias Europeias, apresentando os resultados alcançados pela Aliança STARS EU. Um evento no formato *world café* garantiu que a Aliança seja acessível para todos.
O dia 3 (30 de janeiro) abordou o desenvolvimento de ecossistemas de pesquisa e aprendizagem inovadores, destacando as conexões com as partes interessadas do mercado de trabalho e perspetivas multiculturais para impulsionar o impacto do ensino superior e a competitividade europeia.
O dia 4 (31 de janeiro) revisitou a aceleração do Espaço Europeu de Ensino Superior, enfatizando a criação de programas de formação flexíveis por meio da cooperação entre diversas instituições europeias, particularmente os *Blended Intensive Programmes* (BIPs).

Orlando Rodrigues
Presidente do Instituto Politécnico de Bragança

PREAMBLE

Bragança Polytechnic University | Instituto Politécnico de Bragança, in the third edition of In2CoP, under the title "Conference on International Cooperation in Higher Education – Multicultural Co-creation for Future Societies", focused this year on multicultural co-creation to develop skills for the societies of the future, particularly entrepreneurial and creative skills enriched by cross-cultural perspectives.

The conference spans four days:

Day 1 (January 28) with the official ceremony celebrating the IPB Day, attended by the Minister of Education, Science, and Innovation.
Day 2 (January 29) focuses on international cooperation within the framework of European University Alliances, showcasing the results achieved by STARS EU Alliance. A world café event ensured that the Alliance is for everyone.
Day 3 (January 30) addressed the development of research and innovative learning ecosystems, highlighting connections with labour market stakeholders and multicultural perspectives to boost Higher Education Impact and European competitiveness.
Day 4 (January 31) revisited the acceleration of the European Higher Education Area, emphasizing the creation of flexible training programs through cooperation among multiple European institutions, particularly Blended Intensive Programs (BIPs).

Orlando Rodrigues
President of the Bragança Polytechnic University

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PROGRAMA | PROGRAM

PROGRAMME

January 27

3:00 PM Reception of His Excellency, the Minister of Education, Science, and Innovation

3:30 PM Inauguration of new pedagogical spaces renovated under "Mountain Consortium for Knowledge", PRR project.

4:00 PM Visit to IPB Research Centres

7:30 PM Meeting with Student Board Leaders

6:00 PM Open Forum with the Minister

8:00 PM Social dinner

PROGRAMME

January 28 – IPB Day

Aquarium Room, School of Education

9:00 AM Plenary Meeting of the Coordinating Council of Polytechnic Institutes (CCISP) with the presence of the Minister of Education, Science, and Innovation

[Closed Session for members only]

12:30 PM Working lunch

Dionísio Gonçalves Auditorium, School of Agriculture

2:30 PM IPB Day Commemorative Ceremony
- Keynote Lecture
- Recognition Awards and Medals
  - International Honor Medal: STARS EU Alliance
  - Alumni of the Year Award
  - Best Student Award
  - Staff Seniority Recognition

8:00 PM Social dinner

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27_31 janeiro 2025
Bragança.Portugal

PROGRAMME

January 29 – International Cooperation within European University Alliances

Alcínio Miguel Auditorium, School of Technology and Management

10:00 AM Opening Session
Orlando Rodrigues
Dick Powels
Shkelqim Fortuzi

10:30 AM Join the STARS@IPB
Rima Dijkstra
Data IPB@STARS EU
Luís Pais
Living Labs
Vera Ferro Lebres
Thematic Interest Groups
Filomena Barreiro
Carlos Casimiro da Costa
Joint Degrees
Nuno Moutinho
Ana Isabel Pereira

12:30 AM Working Lunch with STARS EU

Coworking Room, School of Technology and Management

2:00 PM STARS EU is for Everyone
World Cafe Event
With the participation of all STARS EU IPB members

8:00 PM Social dinner

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PROGRAMME

January 30 – IPB's Innovative Learning & Research Ecosystem

Alcínio Miguel Auditorium, School of Technology and Management

10:00 AM Opening Session
Orlando Rodrigues
Maurício Motta

10:30 AM IPB's Innovative Learning Ecosystem
Demola Projects – Final Presentations
Students' Projects Results
Posters & Prototypes Exhibition
Comments by Manuel Heitor & Joana Mendonça

11:15 AM Book Launch: "Design Thinking" by Joana Mendonça
Luís Pais
Joana Mendonça

11:45 AM Design Thinking in Higher Education: A Conversation with Innovators

12:30 AM Working lunch

2:30 PM Align, Act, Accelerate: Research, Technology, and Innovation to Boost European Competitiveness
Manuel Heitor

3:00 PM Collaboration and Impact: Boosting European Research and Innovation
Moderator: Tiago Barbosa
Manuel Heitor
Instituto Politécnico de Bragança Instituto Politécnico do Cávado e do Ave Instituto Politécnico de Coimbra Instituto Politécnico de Portalegre Instituto Politécnico de Porto Instituto Politécnico de Tomar

8:00 PM Social dinner

PROGRAMME

January 31 – Accelerating the European Higher Education Area: The Blended Intensive Programmes Opportunity

Coworking Room, School of Technology and Management

10:00 AM Open Dialogue: Leadership Perspectives on Blended Intensive Programmes
Luís Pais
Adília Fernandes
Carlos Teixeira
Maria José Alves
Nuno Ribeiro
Pedro Bastos
Sónia Nogueira

10:30 AM Blended Intensive Programmes in Action: Results and Lessons Learned IPB Professors & Students

RESUMOS | ABSTRACTS

The Importance of External Veterinary Services for the Promotion of Public Health and Animal Care in the Villages of Bragança

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Introduction: External veterinary care plays a vital role in promoting animal welfare and preventing zoonotic diseases, particularly in rural areas with limited access to veterinary services, such as the villages of Bragança. During the internship at the Vale D'Álvaro Veterinary Clinic, several consultations were carried out to promote the health of both companion and production animals in rural communities, thereby contributing to public health.
Objectives: This report aims to describe the activities carried out during external veterinary visits to villages in the Bragança region, within the framework of the extracurricular internship module *"10% You Choose"*. The focus is on actions targeting animal health and welfare, as well as raising awareness among animal guardians.
Methodology: The activities took place in villages such as Vinhais, Gimonde, Parada, Paradinha, and Vimioso. Services provided included vaccination, animal registration and identification, parasite control, physical examinations, and guidance for animal guardians. Consultations were carried out directly within the villages, ensuring accessibility and providing information to residents.
Results: These actions resulted in the vaccination and parasite control of numerous animals, as well as their identification and registration, contributing to the reduction of disease risks. Animal guardians received guidance on the importance of maintaining up-to-date health protocols, supporting prevention and improving the quality of life of both animals and the families involved.
Conclusions: External veterinary care in the villages of Bragança proved to be an effective strategy to provide support for animals and guidance for their guardians in areas with limited access to veterinary services. The initiatives contributed to animal welfare, disease prevention, and the promotion of public health.

Keywords: Accessibility, animal welfare, public health

Healthy Eating for Better Growth

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Abstract
The main objective of this project is to educate children and young athletes, aged 7 to 14, about the importance of choosing healthy snacks. We aim to encourage balanced eating habits to improve physical performance and recovery before, during, and after training sessions.
The proposal involves creating a "Didactic Lunchbox," which will help children assemble balanced and healthy snacks. The lunchbox will be made of wood and feature compartments representing different food groups, such as carbohydrates, healthy fats, fruits, dairy, and water. This way, children can visualise the ideal amount of each type of food for a complete meal.
While children can place healthy foods in the compartments, they will also have the option to include less healthy items, such as pizza, pancakes, or chocolate cake. If they create an unbalanced lunchbox, the game will provide suggestions and guidance to help them make more informed choices. In this way, children will learn to organise portions correctly and prepare healthy lunchboxes for consumption before and after training, combining fun with learning.
During the initial phase of the project, conducted with athletes from the JDC Revolution Academy in Bragança, a significant increase in awareness and understanding of healthy eating was observed among the participants. The children and young athletes not only understood the importance of balanced nutrition but also began applying this knowledge in practice. The active involvement of all participants made the learning experience more engaging, promoting improvements in dietary habits.
The next steps include expanding the project to other sports institutions and developing educational and personalised materials for coaches, parents, and schools to help promote healthy eating habits across different age groups.

Figure 1: Prototype

REFERENCES

[1] R. Belski, K. Staley, S. Keenan, A. Skiadopoulos, E. Randle, A. Donaldson, P. O'Halloran, P. Kappelides, S. O'Neil, M. Nicholson, "The impact of coaches providing healthy snacks at junior sport training," *Aust N Z J Public Health*, vol. 41, no. 6, pp. 561-566, 2017.

Cardiovascular Diseases

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Abstract

Cardiovascular diseases are currently the most common causes of morbidity and the main cause of mortality in the world. It is therefore essential that these are understood as a current problem, and action is taken to prevent them [1]. Given this context, the main objective of this work is to present the development of an educational game about cardiovascular diseases. The game aims to teach players, interactively, about cardiovascular diseases and their aspects.

The prototype was tested with students in the Curricular Unit of Dietetics and Community Nutrition, taught at the Escola Superior de Saúde do IPB (Polytechnic Institute of Bragança). As a result, positive adherence was obtained, as well as favourable comments regarding the interaction and learning obtained with this game. Despite being applied to students, it should be noted that the game is accessible to various age groups. It is hoped that this activity can, in the future, be an auxiliary instrument for society's learning about cardiovascular diseases, working towards their prevention.

Figure 1: Development of one of the rounds of the interactive game

REFERENCES

[1] https://www.paho.org/pt/topicos/doencas-cardiovasculares

Artventure Bremen

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Introduction: The *Access Art in Public Space* project was designed to enhance the accessibility and visibility of public art in Bremen, Germany. The city is home to over 700 artworks spread throughout its territory, many of which lack identification, making them difficult for residents and visitors to appreciate. In this context, the project proposes the integration of art, tourism, and technology by incorporating gamification elements that track and reward users' progress as they interact with the artworks.
Objectives: The main objective of the project is to develop an intuitive digital tool that, in conjunction with QR codes placed near the artworks, facilitates access to relevant information. The solution aims to enable personalised tours, promote community interaction, and highlight the value of local artistic heritage, turning the cultural exploration experience into an educational and enjoyable activity.
Methodology: The project was developed using Design Thinking methodologies, structured into five key stages. The process involved interviews with the client (*Städtische Galerie im Buntentor*), an in-depth analysis of the urban context, the creation of personas, and case studies. This approach enabled the identification of specific needs of both the client and end-users, guiding the development of the prototype.
Results: The application provides practical and user-friendly access to information through QR code scanning, without requiring user logins. Once registered, users can personalise their tours based on their history and preferences. In addition, the app incorporates gamification features such as leaderboards, the "Artventure Passport", and interactive challenges, fostering a more dynamic and engaging cultural experience.
Conclusion: The project demonstrates strong potential to connect people with public art innovatively and interactively, standing out for its use of personalisation and gamification. By transforming cultural engagement into a more immersive and educational process, the next step will be the global expansion of the project, including new features such as augmented reality to further enhance the user experience.

Keywords: Public art, digital accessibility, interactive tourism, gamification, and cultural preservation

Be Shark – Small Codes, Big Futures

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Introduction: In today's ever-changing world, children are surrounded by technology — yet often as passive consumers. Traditional education lacks engaging tools to teach digital literacy, creativity, and decision-making. These skills are essential for future leaders to solve complex problems in technology, society, and the environment.
Objectives: To create a solution that integrates seamlessly with SharkCoders' classroom activities, reinforcing the skills taught in lessons while encouraging children to think critically, create solutions, and view technology as a tool for innovation. The goal is to make programming fun, interactive, and meaningful.
Methodology: The project was guided by a review of global future trends, scientific literature, and a client-focused study on SharkCoders.
Results: Be Shark is an educational game where children learn to code using Python. In Chapter 1 — our prototype — they help Sharky collect coins to buy a birthday gift for a friend. By combining storytelling and interactivity, the game makes learning to code both accessible and enjoyable.
Conclusions: When we teach children how to code, we teach them how to connect ideas, build solutions, and lead innovation. With *Be Shark*, we are not just teaching programming — we are inspiring the innovators of tomorrow.

Keywords: Gamified learning, serious game, children, and Python programming

BioLens

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Introduction

BioLens is a single-player survival, simulation, and stealth PC game that offers players an immersive experience. In the narrative, the player takes on the role of a biologist exploring an alien planet, tasked with documenting fascinating flora and fauna while navigating the dangers of diverse biomes and avoiding voracious predators. Featuring a visual aesthetic inspired by solarpunk — blending futuristic technology with vibrant, living ecosystems — and drawing on references to Portuguese natural heritage, the game creates a rich and sensorially engaging world. Titles such as *Subnautica* and *Outer Wilds* served as inspiration for this cosmic adventure filled with exploration, discovery, and the delicate balance of life within an ecosystem. *BioLens* is being developed in partnership with the Ecoteca of Mirandela and is currently in the initial prototyping phase.

Positioned within the ecogames movement, *BioLens* explores the intersection between digital games and environmental education, promoting values of sustainability and biodiversity preservation. This genre, which is gaining increasing relevance in the game development landscape, uses narratives and mechanics to raise player awareness about human impact on ecosystems and to encourage more conscious and responsible environmental behaviour.

Objectives

The main objectives of the *BioLens* project are:

1. **Raise awareness about fauna and flora preservation:** Through an engaging narrative and game mechanics simulating interaction with alien biomes, the game aims to foster empathy and understanding of the delicate balance within ecosystems.
2. **Educate through entertainment:** *BioLens* integrates elements of Portuguese natural and cultural heritage, providing players with an educational context that encourages learning about ecology and sustainable coexistence.
3. **Encourage reflection on sustainability:** Beyond promoting respect for nature, the game motivates players to adopt behaviours that minimise negative environmental impacts.
4. **Connect players to local culture:** The use of references to Portuguese natural heritage strengthens the link between global sustainability themes and local cultural specificities.

Methodology
The methodology adopted for the development of *BioLens* includes the following stages:

1. **Brainstorming and problem definition**: Collaborative sessions were held to identify the central problem the game aims to address and to establish the main objectives.
2. **Analysis and data collection**: An investigation was conducted into ecosystems, with particular emphasis on inspirations from Portuguese natural heritage and the ecogames genre.
3. **Production:** During this phase, initial concepts for biomes, fauna, and flora were created, along with visual and mechanical prototypes.
4. **Iterative playtesting:** With each development iteration, tests were carried out to evaluate game mechanics, balance, and player experience.
5. **Review and refinement:** Based on collected feedback, adjustments were made to optimise the design and narrative.
6. **Current prototype:** Implementation of gameplay using the Unity game engine, integrating key mechanics and visual elements as a proof of concept.

Results:
Framed within a design and development process that has already received continued approval from the Ecoteca de Mirandela, the results at this stage include:

- Development of one of the biomes planned for the game, featuring unique plants and animals that reflect the diversity proposed.
- Creation of visual and narrative concepts that connect the player to the ecological theme in a compelling way.
- Production of a functional prototype demonstrating the game's potential as an environmental awareness tool (proof of concept).
- Supporting documentation for the design and development of the project was also produced.

Conclusions:
BioLens is currently at an advanced prototyping stage, with gameplay implemented in the Unity game engine and a clear vision of the developed narrative and mechanical elements. The game shows significant potential within the ecogame genre, promoting environmental education through an interactive and immersive experience.

Next steps include:
1. Expanding the prototype with additional biomes, fauna, and flora.
2. Incorporating further challenges that more deeply explore the relationship between the player and the ecosystem.
3. Refining visuals and narrative to ensure a cohesive and engaging experience. BioLens aims to entertain, inspire, and educate, offering a powerful example of how games can contribute to environmental awareness and reflection on sustainability.

Keywords: Ecogames; Adventure, Ecosystem, Sustainability, Photography, Almanac

Black & White Project – Enhancing the Wool of the Churra Galega Mirandesa Sheep Breed

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Introduction:
The breeding of the Churra Galega Mirandesa sheep breed on the Mirandês Plateau, with centuries of tradition, is essential for the rural economy, landscape preservation, and ecosystem balance. Traditionally, the wool undergoes a predominantly manual multi-step processing, which is time-consuming and costly. Consequently, it has faced devaluation, posing economic and environmental challenges.

Objectives:
To find alternative ways to enhance the value of Churra Galega Mirandesa wool through sustainable, economically viable, environmentally responsible solutions that also protect animal welfare.

Methodology:
A co-creation process was developed to address this issue (and others in the same region where five teams work in parallel: http://cocriacao.ipb.pt/) in the following phases:

1. Kick-off (18/10/2024) for team formation (students, facilitator, and partner) and problem presentation;
2. On-site/context visit (13/11/2024);
3. Online research and problem understanding period (19/10/2024–12/01/2025);
4. Intensive and immersive week on-site/context to develop solutions (13–17/01/2025).

Results:
The proposal is to utilise the entire wool, shortening the process to reduce costs. From washing, three by-products emerge: lanolin (for the cosmetics industry), water (for use in other washing cycles), and dirt (to fertilise nearby land), as well as washed wool. This wool can be used for fillings (duvets, cushions, sofas, stuffed toys...), thermal/acoustic insulation for construction, alternative coverings using a folding system for animal shelters, rural warehouses, or even in refugee camps or for displaced persons affected by natural disasters.

Conclusions:
Churra Galega Mirandesa wool can be exploited for fillings, insulation, and/or coverings. Feasibility studies of these solutions should be undertaken.

Keywords: circular economy, environmental sustainability, thermal and acoustic insulation, filling, covering

Population Control of Stray Cats: An Experience Report from the Vale D'Álvaro Veterinary Clinic

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Introduction: The control of animal populations, particularly stray cats, is an important measure for public health and animal welfare in the Bragança region. During an internship at the Vale D'Álvaro Veterinary Clinic, several initiatives were carried out, including neutering, registration, and microchipping, with the aim of reducing the stray cat population in the area.
Objectives: This report aims to describe participation in stray cat population control initiatives carried out at the Vale D'Álvaro Veterinary Clinic. These actions sought to manage and reduce the number of stray cats in the region.
Methodology: Stray cats were neutered with the support of non-profit associations and individual volunteers. The animals were collected and taken to the Vale D'Álvaro Veterinary Clinic, where they underwent sterilisation procedures. In addition to the medical interventions, awareness was raised among pet owners about the importance of neutering, registration, and maintaining animal health, ensuring that each cat was properly identified, microchipped, and vaccinated.
Results: Over the past three months, several animals were neutered and removed from the streets, contributing significantly to the control of the stray cat population. Following the procedures, all animals were identified, microchipped, vaccinated, and registered. Many were subsequently rehomed through responsible adoption efforts.
Conclusions: The actions undertaken at the Vale D'Álvaro Veterinary Clinic demonstrated that neutering is an effective tool for managing stray cat populations and preventing zoonoses.

Keywords: stray animals, neutering, cats, public health

Cytisus multiflorus (L'Hér.) Sweet Extracts as Promising Natural Agents for Regeneration

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Introduction: Wound healing is a complex biological process essential for restoring skin integrity and function after injury. Major clinical challenges in this field include minimising inflammation and promoting rapid tissue regeneration. Natural products represent a rich source of bioactive compounds with the potential to address these challenges. Notably, *Cytisus multiflorus* (L'Hér.) Sweet, a plant native to Portugal, has traditionally been used in folk medicine to treat various skin conditions.

Objectives: This study aimed to evaluate the therapeutic potential of *C. multiflorus* flower extracts as regenerative agents and to integrate traditional knowledge with scientific evidence.

Methodology: Extracts were prepared using traditional methods (infusion, decoction, and maceration) and analysed for their total phenolic content. Their cytocompatibility with human keratinocytes (HaCaT cell line) was assessed. The wound-healing capacity of the cytocompatible extracts was evaluated using a scratch assay.

Results: Maceration yielded the highest total phenolic content (4.9 ± 0.5 mg GAE/g extract). All extracts were cytocompatible at concentrations ≤12.5 µg/mL over 3 days of culture. Furthermore, all extracts significantly enhanced wound closure, with the infusion showing the most rapid gap closure compared to the untreated control.

Conclusion: *C. multiflorus* flower extracts contain relevant bioactive compounds with promising therapeutic applications in skin regeneration and wound healing. Further studies are needed to isolate the key active constituents and clarify their mechanisms of action.

Keywords: *Cytisus multiflorus* (L'Hér.) Sweet, phenolic compounds, cytocompatibility, bioactivity, wound healing

Development of a Security Framework for Photovoltaic Monitoring Systems

An Entrepreneurial Approach Based on Research

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Introduction: The rapid growth of photovoltaic installations in Portugal and worldwide has created cybersecurity challenges that require innovative solutions. Through research conducted at CeDRI, this project focuses on developing a systematic approach to identify and analyse security vulnerabilities in photovoltaic supervision systems. The work combines academic research with practical applications, aiming to bridge the gap between theoretical understanding and the real security needs of the renewable energy sector.

Objectives: The project combines research and practical objectives through:
- Development of a structured methodology for analysing security vulnerabilities in photovoltaic systems
- Creation of assessment tools to identify potential security threats
- Construction of a framework for evaluating and prioritising security risks
- Exploration of practical applications of the research in real-world scenarios
- Investigation of potential market opportunities for security solutions in renewable energy

Methodology: The research follows a comprehensive approach:
1. Systematic analysis of photovoltaic system architectures and security requirements
2. Development of assessment tools for vulnerability identification
3. Creation of a structured framework for threat analysis
4. Testing and validation in controlled environments
5. Evaluation of practical applications and market needs

Results:
The ongoing project has achieved several important developments:
- Creation of an initial security assessment framework
- Development of basic analysis tools for vulnerability identification
- Documentation of common security challenges in photovoltaic systems
- Preliminary market analysis of security needs in renewable energy
- Identification of potential practical application.

Conclusions: This research project demonstrates the growing intersection between cybersecurity and renewable energy. Although still under development, the work shows promising potential to address real security challenges in the photovoltaic sector. The framework and tools being developed may serve as a foundation for practical security solutions, with possible applications in both commercial and research contexts. The project highlights the opportunity to transform academic research into practical solutions for emerging challenges in renewable energy security.

Keywords: Cybersecurity, Photovoltaic Systems, Security Framework, Renewable Energy, Innovation

Dress Like Caretos

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Abstract

Institutional cooperation between companies and higher education institutions, through the implementation of real-world challenges in educational contexts, provides crucial elements for the understanding of content, enhancing the ability to identify, evaluate, adapt, and apply acquired knowledge to solving various types of problems. Moreover, it has been shown to improve students' decision-making skills, critical and creative thinking, as well as their understanding of global aspects, interdependencies, and multiple perspectives.

Within this framework, we present a project carried out as part of the Design Project Module in the 3rd year of the Bachelor's Degree in Art and Design – Minor in Design at ESE – IPB, in partnership with AFROGENESIS, based in Bragança.

The main goal of the project was to investigate the cultural traditions of Bragança, particularly the Caretos of Podence, and, through design, reinterpret cultural practices with creative solutions that adapt them to new contexts. The project sought to explore the fusion of traditional elements with design, resulting in a prototype that was both functional and representative of the local culture.

The methodology involved in-depth research into the Caretos, central figures of the Podence Carnival, known for their colourful masks, woollen costumes, and bells. Based on this research, the prototype was developed with attention to the vibrant colours, patterns, and textures characteristic of the Caretos' costumes, while integrating them into a modern and functional garment. Collaboration with the CEO of AFROGENESIS, Camila Santos, was essential to understanding the local traditions. Although the company focuses on African culture, particularly Capulana fabrics, valuable insights were gathered on fashion design and the cultural specifics of Bragança, contributing to the incorporation of traditional elements into the prototype, as well as the use of flat pattern modelling techniques for its execution.

The final result of the project is a jacket that combines traditional elements with modern design, creating a piece that celebrates the local culture of Bragança in an innovative and sustainable way.

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Expo Bragança More

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Introduction:
The district of Bragança, with its 12 municipalities, is one of the richest regions in cultural, historical, and natural heritage in Portugal. To enhance the visibility of this wealth of cultural events and attractions, the development of a digital portal called "EXPO Bragança More" is proposed. This website will serve as the virtual hub for the eponymous event, promoting festivities, tourist attractions, and the cultural diversity of the district, connecting tradition and modernity in an interactive experience.

Objectives:
Main Objective: To develop a digital portal that promotes the culture, tourism, and traditions of the 12 municipalities of the Bragança district, functioning as a foundational platform for the future realisation of the event "EXPO Bragança More."
Secondary Objectives:

1. Provide detailed information about the festivities, attractions, and heritage of each municipality.
2. Highlight lesser-known and hard-to-access cultural events, increasing their visibility.
3. Facilitate visit planning to the district through personalised itineraries and interactive tools.
4. Create a digital connection that engages local residents, tourists, and potential sponsors.
5. Raise awareness about the importance of preserving the district's cultural and natural heritage.

Methodology:

1. Portal Planning:

- Structuring content into sections dedicated to each municipality, events, gastronomy, and culture.
- Defining a visual identity that combines traditional elements (Caretos, natural landscapes) with modern features.

2. Technological Development:

- Implementing interactive functionalities such as maps, calendars, and itinerary customisation tools.
- Creating a bilingual interface (Portuguese and English), with the inclusion of Mirandese as a cultural differentiator.

3. Promotion and Engagement:

- Digital marketing strategies, including social media and partnerships with local influencers.
- Offering exclusive content, such as festival videos and virtual tours.

4. Monitoring and Updates:

- Continuous monitoring of portal traffic and user engagement.
- Adapting functionalities and content based on public feedback.

Expected Results from the Methodology

- Increased visibility for the district of Bragança and its municipalities.
- Engagement of visitors, sponsors, and local communities.
- Consolidation of the portal as the digital foundation for the future physical event "EXPO Bragança More".

Results

The "EXPO Bragança More" portal represents a practical and innovative solution to promote and connect the cultural heritage of the Bragança district with a national and international audience. Its implementation will lay the groundwork for a successful physical event, ensuring greater reach and sustainability.

Keywords: EXPO Bragança More, Transmontana Culture, Digital Portal, Tourism Promotion, Cultural Preservation

Fast Harvest – An Arcade-Style Game for the Museum

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Introduction: The "M*useu da Oliveira e do Azeite*", located in Mirandela in the northeast of Portugal, is a cultural landmark dedicated to preserving the rich history of olive oil production. Nestled in an historic building, the museum features a remarkable hydraulic olive press over 100 years old, still in working condition. Surrounded by olive groves and the rural charm of the *Trás-os-Montes* region, the museum immerses visitors in a sensory experience that celebrates the cultural and economic importance of olive oil production. Its mission extends beyond preservation, aiming to foster sustainable local development and pass down centuries of traditions and knowledge to future generations.

Building on the museum's educational and cultural objectives, this project introduces an arcade-style game designed to enhance the visitor experience. The game bridges education and entertainment, offering a fun, interactive way to explore the history and traditions of olive oil harvest. By incorporating the museum's core themes, the game provides a hands-on introduction to the processes and cultural significance of olive oil production.

This arcade-style attraction complements the museum's exhibitions by offering a modern and dynamic element that appeals to visitors of all ages. With an engaging gameplay experience, the game celebrates the heritage of olive-oil production, connecting its traditions with contemporary technology and creating meaningful, memorable moments for museumgoers.

Objectives: The primary objective of this project is to create a unique and engaging experience for visitors to the "*Museu da Oliveira e do Azeite*" in Mirandela. By combining education and entertainment, the aim is to design an interactive game that captivates visitors while deepening their understanding of the rich cultural and historical significance of olive oil production in the region.

The game integrates the museum's core themes and concepts, offering a playful yet educational journey through the traditional processes of olive oil harvest. This approach, encapsulated in the idea of "learning through play," ensures that visitors gain knowledge in an enjoyable and memorable way, fostering a deeper appreciation for this craft.

Moreover, the project aspires to create a replayable experience, incorporating elements of friendly competition to encourage repeat engagement and social interaction among players. This fosters a sense of fun and discovery while reinforcing the knowledge gained during gameplay. Another key goal is to celebrate and share the intergenerational traditions surrounding olive oil production, emphasizing its role in Mirandela's cultural identity and creating connections between generations through gaming.

Ultimately, this project aims to preserve and honor the legacy of olive oil production by bringing its story to life in a modern, interactive format that resonates with visitors of different ages and backgrounds.

Methodologies: The project followed an agile methodology, which provided flexibility and adaptability throughout the design and development process. This approach allowed the team to iteratively and incrementally implement features, make adjustments, and refine the project based on ongoing feedback and testing.

Task distribution was carefully organized to leverage the strengths and expertise of each team member. Tatiana was responsible for designing the user interface (UI), guiding on the creation of 2D art assets and contributing to the game design. Tiago focused on 2D art production, conceptual designs, and illustrations that brought the visual aspects of the game to life. Dumitrue and João worked collaboratively on programming, ensuring the game's functionality and technical aspects. Rami handled all audio-related tasks, including sound effects and background music, while Emma developed marketing assets.

Testing was an integral part of the process, carried out progressively as new features or substantial changes were implemented. This iterative testing approach ensured that potential issues were identified and addressed promptly, maintaining the quality and consistency of the game. To gain deeper insights into the project's development and gather user feedback, an intermediate prototype was evaluated through a structured questionnaire. That survey focused on key elements such as the game's aesthetics, gameplay mechanics, and audio design. The feedback collected was instrumental in guiding refinements.

To support collaboration and documentation, a shared Google Drive was utilized to organize and store all project materials, ensuring accessibility and providing a comprehensive record of the project's development journey to all team members.

Results: The project achieved several key results, reflecting the success of the iterative development process and user feedback integration. Questionnaires proved invaluable in identifying areas for improvement, particularly regarding the visibility of essential in-game elements such as the score and player lives. These insights allowed the team to make targeted adjustments, enhancing the user experience and ensuring clarity in gameplay.

A functional prototype was developed that successfully met the project's primary objectives. The game delivers an engaging and educational experience aligned with the themes and cultural significance of the "Museu da Oliveira e do Azeite" in Mirandela. This prototype serves as a testament to the project's commitment to combining entertainment with cultural preservation.

Beyond the prototype, comprehensive documentation was created to capture each stage of the project's development. The organized repository includes the Game Design Document (GDD), key concept summaries, visual inspiration materials, game assets, and an executive summary. This documentation not only facilitates future updates but also serves as a valuable resource for similar projects.

Conclusion: The project is nearing completion, with the remaining work focused on implementing additional levels to introduce randomness and varying levels of difficulty. These enhancements are crucial for boosting replayability and offering players a dynamic, challenging experience.

A standout feature of the project is the custom-designed arcade casing, which incorporates artwork from the game. This immersive and visually striking element ensures the game integrates seamlessly into the museum environment, creating a memorable attraction for visitors. Additionally, the design documentation specifies button styles and configurations to ensure intuitive gameplay for all age groups, enhancing accessibility and inclusivity.

In summary, the arcade-style game not only complements the "Museu da Oliveira e do Azeite" but also reinforces its mission of cultural preservation and education. By blending traditional heritage with modern interactive technology, the project highlights the rich legacy of olive oil production while offering an engaging and meaningful experience for visitors of all generations.

Keywords: Retro Game; Arcade; Maze; Digital Game; Museum

Fighting The Fake

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Introduction: This project focused on addressing the challenges posed by disinformation, which negatively impacts society, particularly within educational settings. Recognising the essential role of education, we developed an innovative solution designed to strengthen digital literacy and critical thinking, enabling students to navigate the digital world more safely.
Objectives: The project aimed to empower students to identify and resist disinformation by enhancing their critical and digital skills. Another goal was to provide accessible tools and strategies that could be integrated into educational environments, promoting a direct impact on teaching and learning.
Methodology: We adopted a collaborative approach, combining research, brainstorming sessions, and testing to create innovative resources. This included interactive workshops, digital educational tools, and content tailored to students' needs. Partnerships with schools and educators were crucial for validating and refining the proposed solutions.
Results: The project led to the development of interactive educational materials and effective strategies to combat disinformation. Educators reported improved student understanding of disinformation challenges and greater engagement with digital tools. These outcomes reinforce the potential impact of our solution.
Conclusion: The project highlighted the importance of collaboration in developing solutions to complex social challenges. It was an enriching experience that underscored the need for continuous education in digital literacy. For the future, we recommend expanding the reach of the developed solutions, including more resources that address cultural diversity and local needs.

Keywords: Disinformation, Digital Literacy, Critical Thinking, Gamified Learning, Scalable Education

Günter Grass: Art and Digitisation

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Introduction: Günter Grass was an icon of European literature and culture who addressed themes such as German identity and Nazism. To bring his work closer to younger audiences, we created an interactive digital project featuring a website, games, videos, and QR codes to promote exploration of the Günter Grass Foundation archive and to renew his legacy.
Objectives: To make Günter Grass's work more appealing to young adults (18–30 years old) by connecting art, culture, and technology. We used gamification and digital tools to encourage engagement with the Foundation's archive.
Methodology: We analysed Grass's work and interviewed the museum director to understand the needs and expectations. A digital prototype was created using Figma, along with physical materials such as coasters with QR codes. The project was tested and improved based on feedback from students and teachers.
Results: The website includes a video about Günter Grass, a themed game, and links to the official archive. Coasters with QR codes, distributed in bars, encourage access. In the museum, an interactive digital panel showcases and highlights drawings submitted by users.
Conclusions: We demonstrated how technology can revitalise cultural legacy by innovatively combining digital and physical elements. Simple interactive experiences are key to bringing the public closer to art and literature, renewing interest in classical works.

Keywords: Günter Grass, Digital Art, Gamification, Literature, Cultural Innovation

Máquina De Talhar Bolotas

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Introduction: Removing acorn shells without damaging the fruit is a challenge due to the shell's hardness and geometry. Currently, manual separation is required after dehydration, as there is a lack of specific equipment and a need to preserve the separated materials, which have different applications.
Objectives: This project proposes performing longitudinal cuts on acorns using a CO_2 laser before dehydration, aiming to facilitate shell removal, accelerate production, and preserve the raw material. The use of lasers also contributes to productivity gains, as the heat emitted assists in the dehydration process.
Methodology: The properties of acorns were compared with those of other hard-shelled fruits. Tests were conducted using a CO_2 laser on a CNC machine, with cutting parameters defined. The machine design was developed in SolidWorks, integrating a vibrating table and a W-profile conveyor belt to position the acorns beneath two laser tubes.
Results: The ideal superficial cut was achieved using 40W, 6 seconds of exposure, and 400 PPI, without penetrating or damaging the shell. The designed Acorn Cutting Machine demonstrated the capacity to process approximately 28,776 acorns per day.
Conclusions: The use of CO_2 laser offers an efficient and viable solution for longitudinal cuts on acorns, ensuring high production capacity and simple maintenance. The results confirm its industrial applicability and highlight the need to further explore equipment sizing calculations.

Keywords: Acorns, Longitudinal Cutting, CO_2 Laser, Production, Automated System

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Minha Tierra, Minha Lléngua

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Introduction:
The project *"Minha Tierra, Minha Llengua"* was developed to preserve and promote the Mirandese language, a unique cultural and linguistic heritage of Portugal. In collaboration with the *Associaçon de la Lhéngua i Cultura Mirandesa*, the initiative aimed to integrate language learning with cultural appreciation, focusing particularly on younger stakeholders, challenging the common association of cultural heritage with older generations. The project seeks to ensure the sustainability of the language and raise awareness of its significance, thereby strengthening the cultural and social identity of the region.
Drawing from successful models of minority language preservation and incorporating contemporary, gamified approaches to language learning, this project blends educational innovation with community engagement. It highlights the potential of Mirandese as a symbol of cultural cohesion and as a valuable component of Portugal's linguistic diversity.

Objectives:
The main goals of the project include:
· **Promoting the learning of Mirandese:** Making the language more accessible and appealing, particularly to younger audiences, through digital and interactive tools.
· **Strengthening local cultural identity:** Emphasising the importance of the language as an essential part of Miranda do Douro's cultural heritage.
· **Creating replicable solutions:** Developing an innovative model that can be adapted to support the preservation of other minority languages.
· **Integrating the language into daily life:** Offering practical and immersive experiences, such as games, stories, living libraries, and dedicated usage spaces.

Methodology:
To achieve its goals, the project followed a structured approach comprising the following stages:

1. **Analysis of linguistic and cultural needs:**
   Identification of the main challenges in preserving the Mirandese language, based on local data and consultations with subject-matter experts.
2. **Development of digital solutions:**
   - **Creation of the virtual influencer "Fulo":** Named after the Mirandese word for "flower," Fulo is a charismatic AI character designed to engage younger audiences through social media platforms.
   - **Design of an interactive platform:** Featuring games, stories, a living library, and dedicated spaces for linguistic use, this platform proposes practical activities to encourage language immersion.
3. **Community engagement:**
   Organisation of workshops, cultural events, and participatory sessions to validate the proposed solutions and incorporate local feedback.

4. **Playtesting and refinement:**
   Testing of the developed digital tools with diverse user groups to gather insights and improve the final solutions

Results:
The project yielded three main insights:

1. A growing interest in the Mirandese language among younger generations, driven by the use of innovative digital approaches that spark curiosity and engagement, thereby broadening the language's reach.
2. The crucial role of community engagement in preserving the language and strengthening cultural identity. Collaboration between local community members and experts was essential to validate and enrich the proposed initiatives. These efforts also demonstrated the potential of practical activities conducted in diverse territorial contexts (informal learning environments).
3. The feasibility of linking language learning with broader social and economic development, ensuring both the sustainability of the language and the resilience of the community.

Conclusions:
The *Minha Tierra, Minha Lléngua* project demonstrates that it is possible to revitalise minority languages by integrating educational innovation with cultural preservation. The tools developed provide a replicable model that can be adapted to other endangered languages, underlining the importance of integrated actions that bring together technology, community, and education.
By promoting the long-term sustainability of the Mirandese language, the project reinforces its role as a vital link between past, present, and future, ensuring that new generations recognise and value this unique cultural heritage.

Research on *Varroa spp.* Mite

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Introduction: *Apis mellifera L.* plays a vital role in beekeeping across Portugal. However, it faces significant health challenges, notably parasitism by the mite *Varroa spp.*, which compromises hive health and facilitates the spread of various diseases. This ectoparasite affects both adult bees and brood combs, reducing colony longevity and impacting productivity. The Apicultural Pathology Laboratory at ESAB carries out diagnostic analyses to detect infestations and support effective control strategies.
Objectives: This study aimed to assess *Varroa spp.* infestation in beehives through laboratory-based diagnostic methods and systematic sample tracking, providing a foundation for informed management strategies.
Methodology: A total of 109 samples of adult bees and brood combs were analysed between October 2024 and January 2025. The collection followed standardised protocols to ensure data representativeness. Diagnosis involved manual mite counts and binocular magnification analysis, with data organised and processed using Microsoft Excel.
Results: Findings revealed that 74.3% of the samples tested positive for *Varroa spp.*, with high infestation levels observed in 92.5% of brood combs. Infestation rates exceeding 15% in worker bees and 30% in drones indicate an urgent need for intervention against Varroosis.
Conclusions:
The high infestation rates highlight the critical need for continuous monitoring. Strict control measures are essential to mitigate the effects of *Varroa spp.*, ensuring the survival of colonies and the sustainability of apicultural production.

Keywords: Pathogens: Sustainability; Tracking; Infection; Monitoring

Internship Project – Future of Career through the Eyes of YOUTH

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Introduction: The "Future of Career through the Eyes of YOUTH" (FOC) project, approved under the Erasmus+ programme, aims to empower young people to explore the labour market creatively and inclusively. Developed in partnership with MORE CoLAB and the Polytechnic Institute of Bragança (IPB), the exchange programme in Poland brought together Brazilian and Polish students for activities focused on professional and intercultural development.
Objectives: Key objectives included writing a chapter for a best practices manual on employability, participating in lectures, fairs, and workshops, and delivering a presentation on Portuguese culture.
Methodology: The chapter, centred on soft skills, hard skills, internships, and extracurricular activities, was based on research from specialised sources and reviewed and validated by MORE CoLAB. The presentation on Portuguese culture addressed themes such as history, gastronomy, and traditions, using visual and interactive resources to engage secondary school students.
Results: The project outcomes include the development of a manual guiding young people in acquiring essential skills, intercultural exchange during the mobility, and events that fostered communication and creativity. The cultural presentation contributed to awareness of Portugal's diversity, reinforcing the global impact of the initiative.
Conclusions: The FOC project demonstrated that the integration of practical learning, international collaboration, and the development of key competences effectively prepares youth to face the challenges of an ever-evolving job market.

Ervas e os Seus Encantos

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Abstract
This activity, entitled *"Herbs and Their Charms"*, was held at the Centro Social Paroquial de Santo Condestável in Bragança, Portugal, with a particular focus on elderly participants. The initiative sought to raise awareness of the properties, benefits, and principal uses of aromatic herbs within this demographic. Through sensory engagement, including smelling and touching different herbs, attendees explored their applications in supporting health and well-being. Special emphasis was placed on the contribution of these herbs to the management of prevalent health conditions among older adults, such as diabetes, hypertension, and cardiovascular disease. The event aimed to empower the elderly by promoting natural remedies and encouraging their integration into daily routines to improve health outcomes. Future activities are planned to further develop this educational approach, tailored to the specific needs of senior citizens.

Reino dos Alimentos

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Abstract

The challenge is to promote nutritional education in a playful and interactive way for children in the 4th grade (9 to 10 years old).

The proposal will be carried out through participation in a didactic and interactive game called “Reino dos Alimentos”, which aims to teach concepts about healthy eating, using an approach and language adapted to the age group.

The “Reino dos Alimentos” game is based on nutritional education and features a board divided into themed squares. Along the way, information about food, the food wheel, nutrients and the gastrointestinal tract will be explored. To reinforce the cultural link with the city of Bragança, the game's pawns represent local symbols such as the careto, the cantarinhas, the pastor, the castle and the train.

The game’s teaching objectives:

- Identify natural foods and their functions in the body.
- Explain the food wheel groups and the importance of each in our daily diet.
- Demonstrate the role of nutrients in energy, growth and health maintenance.
- Explain in a simplified way how the gastrointestinal tract works and how food passes through the body.

The participating children will answer questions and complete challenges to advance on the board. If the answers are correct, they will be allowed to progress in the game, encouraging the use of knowledge and creativity in a fun and challenging way.

We hope that the game will contribute to the development of children's social and nutritional skills by providing a fun experience. The ultimate goal is to awaken an interest in health and motivate children to adopt healthy eating choices and habits that will be reflected in their lives.

As an expansion of the project, we planned to sell the “Roda dos Alimentos” game, including more activities and information. The proposal would be to explore new skills and develop knowledge, adapting the material for wider age groups, promoting continuous learning.

Figure 1: Prototype

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Matracas Cultural Festival: Preserving and Revitalising Mirandese Traditions Through Innovation

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Introduction: The cultural heritage of Miranda do Douro, particularly its music and traditions, faces the risk of being overshadowed by globalisation and a lack of recognition as a cultural destination. Without intervention, these traditions may fade from collective memory.

Objectives: The Matracas Cultural Festival is designed to celebrate, preserve, and modernise Mirandese traditions. Through a six-day event, it aims to strengthen cultural identity, support the local economy, and engage diverse audiences by integrating traditional elements with digital innovation.

Methodology: The festival combines live performances, traditional dances, local gastronomy, and interactive workshops enhanced with VR technology. This approach offers an immersive experience that appeals to both local and international audiences while ensuring accessibility across generations.

Results: The festival fosters cultural preservation while driving economic growth and increasing international recognition of Mirandese traditions. Expected outcomes include heightened interest in local heritage, increased revenue for regional businesses, and a stronger connection between younger generations and their cultural roots through digital engagement.

Conclusions: By blending tradition with innovation, the Matracas Cultural Festival establishes a sustainable model for cultural preservation and community engagement. It has the potential to position Miranda do Douro as a cultural hub, ensuring the longevity and global appreciation of its rich heritage.

Key words: Mirandese culture, cultural preservation, festival, traditional music, community engagement

Echoes of the Great War

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Introduction: *Echoes of the Great War* is an educational game designed to immerse players in the historical context of the First World War. It is a non-violent, family-friendly experience that blends entertainment with learning. Drawing inspiration and factual content from the *Musée de la Grande Guerre* (French Museum of the Great War), the project adopts a pixel art aesthetic and focuses on accessible gameplay mechanics, making it suitable for players of all ages, with a particular emphasis on children.

Objectives: The primary aim of *Echoes of the Great War* is to educate players about World War I through an interactive medium. In parallel, the project served as a platform for me to develop and enhance my programming skills, explore new approaches in game development, and gain practical experience managing a collaborative project within the Unity engine. Key goals included designing player-friendly mechanics and delivering a game that is both engaging and visually appealing.

Methodology: The game was developed using the Unity engine, following the MDA (Mechanics–Dynamics–Aesthetics) framework to ensure a cohesive player experience. The chosen visual style — low-poly pixel art — was selected both for accessibility and to evoke a sense of historical authenticity. Development was structured around sprint-based collaboration, integrating core elements such as gameplay mechanics, narrative design, and historical content. Although there was no direct collaboration with the *Musée de la Grande Guerre*, publicly available materials from the museum were extensively used to build a historically grounded foundation.

Gameplay progresses through levels that gradually introduce the themes of the Great War. Players are guided by "Captain", a WWI medical dog, who provides both assistance and historical context throughout the journey. Core gameplay features include collecting and examining artefacts, solving puzzles, and exploring a “Battlefield” environment. A key development focus was to ensure smooth and intuitive gameplay to offer players a genuinely engaging and accessible experience.

Results:

- Development of a functional Main Menu and In-Game Menu.
- Creation of an introductory cutscene to establish the tone and narrative direction of the game.
- Design of a tutorial level (featuring placeholder assets) and a fully developed “Battlefield” level.
- Implementation of core gameplay mechanics, including artefact collection, artefact inspection, and image-based puzzles (jigsaw-style).
- Design and integration of game assets into the “Battlefield” level, including the character "Captain" and approximately half of the artefacts used (with the remaining assets represented by placeholders).

- Creation of splash art and a cohesive visual brand for the game.

Conclusions: *Echoes of the Great War* successfully combines educational content with entertainment, delivering an engaging and age-appropriate experience for players of all backgrounds. By presenting the historical setting in a non-violent and visually appealing format, the game offers an accessible entry point for learning about the First World War. The project demonstrates significant potential in how it brings history to life and fosters curiosity among younger audiences, highlighting the effectiveness of interactive media in educational contexts.

Keywords: World War I, Educational Game, Pixel Art, 2D Game, Unity Engine

Serious Play in Public Service: Game Design for Local Public Administration Innovation

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Abstract
The INNLocal project develops tools to diagnose and foster a culture of innovation within local public administrations. Grounded in the OECD's Oslo Manual definition of innovation—encompassing significant improvements in goods, services, or processes to enhance public management and societal services—the project introduces the Local Innovation Culture Self-Assessment Tool (FACIL). Adapted from the FACI tool, originally designed for the Portuguese central government, FACIL addresses the unique challenges of local administrations by evaluating ten dimensions of innovation culture: strategy, leadership, people, structure, incentives, tools, risk management, networks and knowledge, public procurement, and financing. The transformation of FACIL into the FACIL Game added an interactive, gamified approach, combining global applicability via questionnaires with localised implementation through gamified activities. Using a Likert scale from 1 to 7, the game fosters participatory and reflective environments. Initially, the FACIL Game enabled municipal employees to collaboratively evaluate innovation practices and identify improvement strategies. Its second phase expanded to include environmental sustainability, diversity and inclusion, and citizen participation. This gamified format not only measures innovation maturity but also promotes knowledge sharing and the development of replicable solutions. Results highlight the game's effectiveness as an innovation barometer for Portuguese municipalities, pinpointing priority areas for intervention while enhancing civil servant engagement. By improving efficiency, transparency, and service quality, the game places innovation at the core of addressing social and economic challenges, transforming public administrations into resilient, efficient, and citizen-focused organisations. The FACIL Game establishes a robust framework for fostering innovation in local governments, driving a more agile, inclusive, and sustainable future. Building on the adaptation of the Local Innovation Culture Self-Assessment Tool (FACIL), the project extended its scope by introducing an interactive and dynamic game, the INNlocal Card Game. This game serves as a practical instrument for institutional analysis, reflection, and improvement.

Keywords: Innovation in the Public Sector, Innovation Culture, Innovation Culture Self-Assessment Tool, Portuguese Local Governments, Gamification

REFERENCES

[1] Dupret, K., Jørgensen, L., & Andersen, L. B. (2022). *The promise of learning through gaming at work*. Research in Organisational Change and Development. Retrieved from https://ruc.dk/en/publications/the-promise-of-learning-through-gaming-at-work

[2] Freire, M. J. (2008). *Facilitadores e Barreiras à Inovação nos Serviços de Atendimento da Administração Pública* (Master's thesis, Universidade de Aveiro, Aveiro, Portugal).

[3] Hamari, J., Koivisto, J., & Sarsa, H. (2014). Does gamification work? — A literature review of empirical studies on gamification. *Proceedings of the Annual Hawaii International Conference on System Sciences, 47*, 3025–3034. https://doi.org/10.1109/HICSS.2014.377

[4] OECD (2023). *Global Trends in Government Innovation 2023*. OECD Public Governance Reviews, OECD Publishing, Paris. https://doi.org/10.1787/0655b570-en

[5] OECD/Eurostat (2018). *Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation* (4th ed.). https://doi.org/10.1787/9789264304604-en

[6] Oliveira, V. R. M. (2015). *Inovação no Setor Público em Portugal: A Perspetiva dos Cidadãos* (Master's thesis, Universidade da Beira Interior, Covilhã, Portugal).

[7] Rodríguez-García, A. M., Moreno-Fernández, M. M., & López-Belmonte, J. (2021). Gamification as a methodological resource in higher education: A systematic review. *Educational Research Review, 35*, 100396. https://doi.org/10.1016/j.edurev.2021.100396

Healthy food basket for healthy basketball players

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Abstract
Activity Description: "Healthy Baskets"
The activity "Healthy Baskets" aims to promote nutritional education in a playful and interactive way for children aged 6 to 12. The activity will involve a participatory dynamic where children will learn to identify and classify foods based on their characteristics and impact on health.
Activity Dynamics
The activity involves presenting the children with an illustrated list of foods, including healthy and unhealthy options. They will be divided into small groups, and each group will receive two baskets: one for healthy foods and another for unhealthy foods. The task is to classify the foods by placing them in the appropriate basket based on their prior knowledge or the explanations provided during the activity.
After the classification, a facilitator will conduct a brief interactive explanation, discussing with the participants:

- Why certain foods are healthy and should be consumed more frequently.
- Why other foods are less healthy and should be consumed in moderation.
- The importance of a balanced diet for growth, energy, and overall health.

Educational Objectives of the Activity

- To identify healthy and unhealthy foods practically and visually.
- To understand the impact of foods on health and well-being.
- To encourage conscious decision-making by promoting balanced food choices.
- To foster teamwork and collaboration by solving the classification task as a group.

Activity Structure

- Introduction (10 minutes)
- Present the activity and explain the concept of healthy and unhealthy foods. Food Classification (20 minutes)
- Children receive the baskets and the food list.
- Each group discusses and decides where to place each food item. Discussion and Feedback (15 minutes)
- The facilitator reviews the groups' choices and explains the reasoning behind each classification.
- Questions and discussions are encouraged to reinforce learning.
- Summarise what was learned and distribute an illustrated handout with tips for healthy eating.

Figure 1: Prototype

Healthy Foods

1. Apple
2. Banana
3. Carrot
4. Broccoli
5. Spinach
6. Tomato
7. Oats
8. Black beans
9. Grilled chicken
10. Fish (salmon or sardines)
11. Boiled egg
12. Unsweetened natural yoghurt
13. Fresh cheese
14. Walnuts
15. Olive oil
16. Brown rice
17. Sweet potato
18. Avocado
19. Pear
20. Water

Unhealthy Foods

1. Packaged potato chips
2. Soft drinks (e.g., cola)
3. Filled biscuits
4. Dulce de leche or caramel
5. Fast food hamburger
6. Frozen pizza with extra cheese
7. Processed chicken nuggets
8. Hot dog with industrialised sausage
9. Gummies
10. Hard candies
11. Chocolate ice cream
12. Fried meat or cheese pastry
13. Chocolate-filled croissant
14. Sugary breakfast cereals
15. White bread with butter
16. Processed mayonnaise
17. Industrialised chocolate milk
18. Non-alcoholic beer (to reinforce conscious choices at home)
19. Microwave popcorn with butter
20. Cheese-flavoured snacks

Arrive: How to Increase Digital Skills for Marginalized Learners and Support Their Access to Education?

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Introduction: Digital literacy is a common challenge among refugees, caused by forced displacement, language barriers, and disrupted education. Marginalised adolescents, in particular, struggle to adapt and access essential digital resources. This work aimed to develop *Arrive*, a digital platform for refugee adolescents in Sweden. The platform focuses on building digital skills and easing social and educational integration by centralising support resources and connecting users to local initiatives.
Objectives: Promote digital inclusion and essential skills. Facilitate social and educational integration for refugees. Centralise support resources in a user-friendly digital platform.
Methodology: Using design thinking, the project involved regular meetings, research, feedback sessions, persona creation to represent refugee adolescents, and a week-long face-to-face week in Groningen, the Netherlands. The interface was developed using Figma, and functionalities like quizzes, a catalogue of organisations, and a chat feature were prototyped and refined.
Results: The *Arrive* platform consolidates scattered information into a free, multilingual potential website and app. Key features include a quiz for personalised recommendations and a map of local initiatives.
Conclusions: *Arrive* has the potential to reduce educational barriers and foster digital inclusion for refugee adolescents, with scalability to other global contexts.

Keywords: Digital inclusion, Refugees, Support platform, Adolescents

BIP IntegratedProject / BIP Projeto Integrado

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Introduction: The Integrated Project is a BIP ERASMUS+ programme that, in 2024, is running its fourth edition. It combines online and in-person sessions, involving students from various European partner institutions. The project is part of the Integrated Project course unit within the Multimedia degree at EsACT, offering students an international and multidisciplinary experience in project creation.
Objectives: Through this BIP programme, the aim is to explore the social and cultural geographies of communities, valuing their origins and specific identities by implementing co-creation strategies. Markets, as historic and social hubs, are understood as essential spaces for preserving traditions, languages, and identities. The thematic framework focuses on local markets and their culture, promoting the relationship between space, community, and traditions. In this context, active research and the application of systemic methodologies are considered fundamental to understanding and representing the identity of markets and communities across Europe, connecting past, present, and future. This broad approach enables the development of creative projects that involve multiple forms of expression, such as animation, photography, film, architecture, music, and digital media.
Methodology: The programme's methodology is based on direct interaction with markets and communities, applying co-creation strategies that involve field research, collection of testimonies, visual documentation, and artistic experimentation. Emphasis is placed on observing and exploring local narratives, focusing on building visual discourses that express the identity and dynamism of markets. The integration of various media and techniques allows the creation of multidisciplinary projects, fostering collaboration among students from different fields and nationalities.
Results: The two projects developed in 2023 illustrate the outcomes of this programme. The first, *A vida de toda a gente* (Everyone's Life), is an essay film centred on the market of Mirandela, exploring its atmosphere and the daily life of its visitors. The second, *Gente do Mercado* (Market People), presents through illustration the individuals who play a fundamental and daily role in Mirandela's market, highlighting the importance of their stories and presence in shaping local identity.
Conclusions:
These projects reinforce the importance of linking education, culture, and community, providing students with practical and collaborative learning experiences. Valuing markets as social and cultural spaces, combined with diverse creative approaches, enables students to develop both knowledge and technical and artistic skills, while contributing to the preservation of European community identities.

Keywords: BIP, ERASMUS+, integrated project, multimedia, co-creation, systemic methodologies, local markets, cultural identity, traditions, communities, multimedia heritage, Mirandela, storytelling, interdisciplinarity, EsACT, IPB

"Eat Well, Grow Healthy"

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Abstract
This work explored the challenge of developing an interactive educational tool to promote healthy eating habits among children aged 6 to 12 playfully and pedagogically. This arose due to the increasing prevalence of inadequate food choices, since one of the main causes of childhood obesity comes from food, and one of the easiest ways to prevent these habits is to teach and inform children to adopt healthier lifestyles. Subsequently, this work aimed to develop a memory game, in card format, where each card presents either a food or an associated macronutrient or micronutrient, accompanied by a simple illustration and description. This prototype proved to have the potential to improve children's knowledge of healthy foods and their nutritional benefits in a fun and interactive way. In the future, the aim is to expand the game to include more foods and nutrients in different school contexts and age groups. Finally, the work highlights the importance of co-creative initiatives, contributing to the development of effective tools for healthy eating from childhood that aim to promote food education [1].

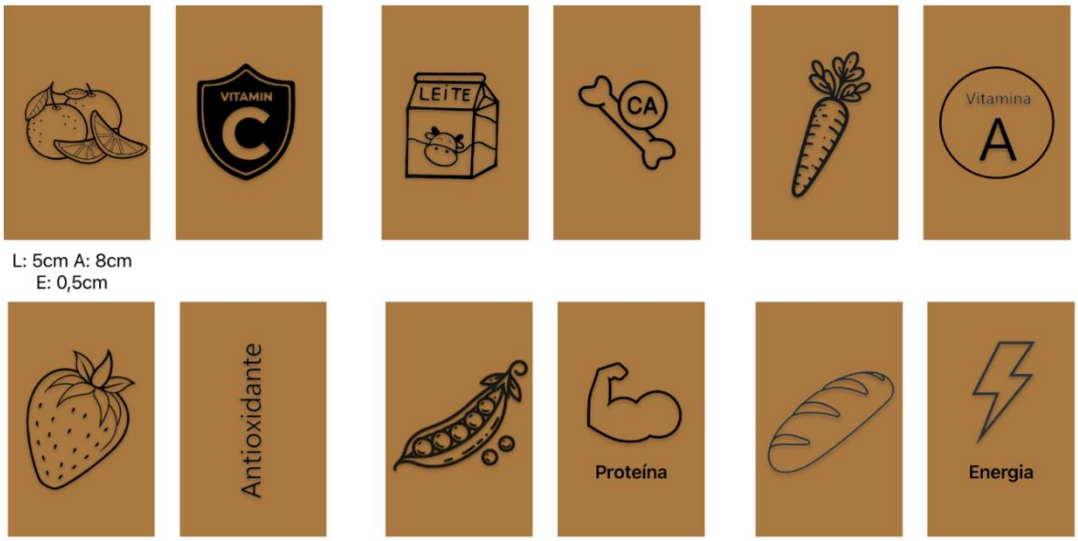

Figure 1: Prototype of didatic material

REFERENCES

[1] Obesidade infantil [Internet]. Available from: https://www.sns24.gov.pt/tema/saude-da-crianca/obesidade-infantil/

Development of a Bioproduct Based on Tilapia Skin and Hyaluronic Acid for the Treatment of Burns

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Abstract

This study presents the development of an innovative bioproduct using Nile tilapia skin and hyaluronic acid (HA) for medical applications in the treatment of burns. For this, tilapia skin will be used as a biological matrix, while hyaluronic acid will be incorporated into the material to enhance its healing, regenerative and moisturising properties.

The HA is a natural polysaccharide with moisturising, regenerative and anti-inflammatory properties, essential for wound healing [1], [2]. Tilapia skin, rich in type I collagen, has demonstrated efficacy as a biological dressing in clinical trials, enhancing its healing properties [3], [4].

The bioproduct development process includes the preparation of tilapia skin, with cleaning, dehydration by freeze-drying and sterilisation by gamma irradiation steps, ensuring safety and preservation of biological properties [5], [6]. The incorporation of HA into the collagen matrix occurs through specific chemical interactions that create a cohesive structure with optimised viscoelastic properties. [7].

Previous results indicate that the use of tilapia skin reduces healing time, pain, and treatment costs, while HA promotes tissue regeneration by maintaining an optimal moist environment for cellular repair [6]. This bioproduct represents an effective and low-cost alternative for burn treatment, highlighting the synergy between renewable biomaterials and natural biopolymers. Future studies should focus on standardising HA concentrations and conducting large-scale clinical validation.

REFERENCES

[1] E. V. Shikina, R. A. Kovalevsky, A. I. Shirkovskaya, e Ph. V. Toukach, «Prospective bacterial and fungal sources of hyaluronic acid: A review», *Comput. Struct. Biotechnol. J.*, vol. 20, pp. 6214–6236, 2022, doi: 10.1016/j.csbj.2022.11.013.

[2] A. C. Silva, B. B. Cintra, J. B. B. L. Maia, F. D. S. D. Couto, e C. V. B. L. D. Oliveira, «Tratamento de queimaduras de 2° grau com Ácido Hialurônico 0,2%: Revisão integrativa da literatura», *Res. Soc. Dev.*, vol. 12, n.° 9, p. e5512943161, set. 2023, doi: 10.33448/rsd-v12i9.43161.

[3] A. Afifah, O. Suparno, L. Haditjaroko, e K. Tarman, «Utilisation of fish skin waste as a collagen wound dressing on burn injuries: a mini review», *IOP Conf. Ser. Earth Environ. Sci.*, vol. 335, n.° 1, p. 012031, out. 2019, doi: 10.1088/1755-1315/335/1/012031.

[4] H. Ahn *et al.*, «Mechanical Properties of Porcine and Fish Skin-Based Collagen and Conjugated Collagen Fibres», *Polymers*, vol. 13, n.° 13, p. 2151, jun. 2021, doi: 10.3390/polym13132151.

[5] A. Ibrahim, H. M. Fahmy, G. A.-E. Mahmoud, M. Soliman, e A. M. Elshahawy, «New strategies for sterilization and preservation of fresh fish skin grafts», *Sci. Rep.*, vol. 14, n.° 1, p. 1253, jan. 2024, doi: 10.1038/s41598-024-51608-4.

[6] E. M. Lima Júnior *et al.*, «A Randomized Comparison Study of Lyophilized Nile Tilapia Skin and Silver-Impregnated Sodium Carboxymethylcellulose for the Treatment of Superficial Partial-Thickness Burns», *J. Burn Care Res.*, vol. 42, n.° 1, pp. 41–48, fev. 2021, doi: 10.1093/jbcr/iraa099.

[7] M. Chopin-Doroteo, R. M. Salgado-Curiel, J. Pérez-González, B. M. Marín-Santibáñez, e E. Krötzsch, «Fibroblast populated collagen lattices exhibit opposite biophysical conditions by fibrin or hyaluronic acid supplementation», *J. Mech. Behav. Biomed. Mater.*, vol. 82, pp. 310–319, jun. 2018, doi: 10.1016/j.jmbbm.2018.03.042.

Development of Functional Gummies Incorporating Pectin and Ergosterol with Hypocholesterolemic Activity

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Abstract
In recent years, the development of functional food products has been driven by the search for innovative solutions to global health challenges, such as hypercholesterolemia. Cardiovascular diseases remain the leading cause of mortality worldwide, with atherosclerosis being one of the most common cardiovascular diseases, characterised by elevated cholesterol levels [1].
Pectin, a natural polysaccharide found in plant cell walls, is widely used in the food industry due to its gelling and thickening properties. Additionally, it exhibits notable hypocholesterolemic potential by reducing cholesterol absorption and promoting its excretion [2].
Ergosterol is a predominant mycosterol in mushrooms, possesses various bioactive properties, including antioxidant, anti-inflammatory, and hypocholesterolemic activities. It acts by decreasing intestinal cholesterol absorption [3].
This study proposes the formulation of functional gummies using biopolymers such as pectin and ergosterol, highlighting their functional and sustainable benefits. Specifically, pectin will be extracted from orange peels through a chemical method involving acid-aqueous extraction, purification, and ethanol precipitation. For ergosterol, an ultrasound-assisted extraction technique will be employed using ethanol as a solvent, followed by encapsulation via spray drying to preserve its stability and bioactivity. The gummy production process will involve dissolving pectin in heated water, incorporating the encapsulated ergosterol, and optimising pH to enhance gelation.
The goal of this development is to obtain gummies with favourable sensory characteristics, high bioavailability, and significant hypocholesterolemic potential.
The combination of pectin and ergosterol in functional gummies presents substantial therapeutic and functional potential. Enriched gummies containing pectin and ergosterol offer an accessible, convenient, and effective solution for promoting a healthy lifestyle and enhancing cardiovascular health benefits.

REFERENCES

[1] World Heart Federation. Atualização: Roterio de Colesterol, 2019.
[2] Dambuza, A.; Rungqu, P.; Oyedeji, A. O.; Miya, G.; Oriola, A. O.; Hosu, Y. S.; Oyedeji, O. O. Therapeutic Potential of Pectin and Its Derivatives in Chronic Diseases. *Molecules* 2024, *29* (4), 896.
[3] Francisco C; Isabel C.F.R. Ferreira; Maria Filomena F. Barreiro; Odinei Hess Gonçalves. *Micoesteróis como Agentes Funcionalizantes: Ensaios de Modificação Química do Ergosterol, Estabilização de Extratos de Micoesteróes e Desenvolvimento de Aplicações*).

Donkey Wonderland

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Introduction: The idea is to organise educational and recreational activities that contribute to combating loneliness among the elderly and to better understand these amazing animals. To reach this, AEPGA intends to organise donkey mediation activities that involve elderly people interacting with donkeys, aiming to mitigate several physical, mental and social health problems. Donkeys and the elderly, surprisingly, share a slower pace of life and a pearl of wisdom that comes with age. Donkeys are known for their calm demeanour, gentleness, sweetness, patience and resilience, which are qualities valued in old age. This interaction can emphasise the importance of care and well-being for animals, fostering a sense of purpose and connection with nature. In short, the well-being of people can be achieved alongside the well-being of animals (donkeys).

Objectives: Better wealth being, bring happiness to both donkeys and the elders.

Methodology: The WE project approach, in which a team of multidisciplinary and multicultural talents, through a simple co-creative design process, achieves the solution to the challenge proposed by the partner.

Result: Join us for a special weekend dedicated to Mirandês Donkey. Interactive and educational activities for all ages. Sponsor a donkey and support its preservation. Meet Tó, our star donkey, and follow his dedicated page on social media. Learn, connect, and help preserve this incredible part of our heritage.

Conclusions: The organisation was already carrying out various activities to bring people and donkeys together. Our solution enhances the communication of this activity and adds creativity to the work already being done.

Key words: Mediation, nature, communication, wellbeing

Eco-Friendly Innovation: Starch-Based Deodorant from Potato Peels

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Abstract

Potato peels, a major by-product of one of the world's most widely consumed vegetables, offer an appealing opportunity for sustainable innovation. Globally, potato production exceeds 376 million tons annually, and it is estimated that approximately 8,000 kilotons of potato peel waste could be generated by 2030 [1].

This study used the method proposed by Nowotny et al. (1972) [2], an environmentally friendly process for high-purity starch extraction from potato peel waste, employing it as a key raw material in the formulation of a natural, dry deodorant branded as Potato Glow (Figure 1). The extraction process involved mechanical grinding, washing, sedimentation, and purification steps to obtain starch of the quality required for cosmetic applications.

The deodorant was formulated to provide a long-lasting aroma, a soft and powdery feel, non-staining application, and skin compatibility, with a suitable pH of approximately 6. Its alcohol-free composition, combined with the presence of kaolin clay, improved the usability and reduced the ecological footprint of the product. Additionally, two distinct fragrances were developed to cater to the preferences of both men and women. A user survey involving 20 participants validated the deodorant's effectiveness, comfort, and eco-friendliness.

Through the conversion of potato peel waste into a marketable cosmetic item, this study demonstrates the importance of waste valorisation for minimising the environmental footprint and simultaneously providing high-performance, eco-friendly alternatives to standard deodorants.

Figure 1. Logo (left) and final prototype (right) of the starch-based deodorant

REFERENCES

[1] FAO. Food and Agriculture Organisation of the United Nations, FAOSTAT Statistical Database, 2021.

[2] F. Nowotny, "Technologia przetwórstwa ziemniaczanego", WNT Warsaw, Poland

This work was part of the 'Chemistry Project' course in the Chemical Engineering Bachelor's program at the Polytechnic Institute of Bragança (2024/2025), focusing on valorising food industry by-products.

Estudar Graça Morais – Visão Popular de uma Artista Local

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Introduction: Graça Morais, a Portuguese artist born in the Bragança region, conveys in her work a deep connection to her past, portraying themes of sorrow, suffering, and the passage of time. Her paintings often incorporate powerful symbols such as death, blood, and fire, represented through both human and animal forms. The Contemporary Art Centre that bears her name, located in Bragança, houses a significant collection of her works as well as those of other artists. It offers the local community a space to engage with and interpret the work of an artist who remains both relevant and socially conscious, addressing not only environmental concerns but also pressing human issues such as war, persecution, and injustice.
Objectives: This project aimed to explore and analyse the work of Graça Morais, bridging a theoretical understanding of her artistic output with the perceptions and interpretations of the public who experience it firsthand.
Methodology: The project involved filming and photographing selected artworks, cataloguing pieces, conducting on-site 'vox pop' interviews, drafting a narrative script, and editing the final audiovisual piece.
Results: The outcome is a 10-minute documentary that examines the life and work of Graça Morais, as well as the public's engagement with her art at the Graça Morais Contemporary Art Centre.
Conclusions: Through the documentary, we collected a variety of personal responses to Morais's work, some of which were integrated into the final voice-over narration, while others served as background insight. These testimonies reflect a wide spectrum of emotions and interpretations, highlighting the complexity and richness of the artist's impact. The project ultimately sought to draw connections between Morais's reality and the way it is expressed in her artistic practice.

Keywords: Graça Morais, documentary, contemporary art, cultural identity, audience reception

Improving Food Storage and Hygiene Practices in Educational Settings

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Abstract

This project addresses challenges in food storage and hygiene, focusing on educational settings to be implemented in the IPB community garden. The principal goal in this work is to teach the proper way of hygiene and food storage of the food that is planted in the IPB community garden, which includes: cabbage, lettuce, tomato, apple, grape, nuts, potato and carrot.

A co-creation approach involving students and faculty at Instituto Politécnico de Bragança was utilised to develop solutions. Recommendations include educating individuals on how to properly freeze suitable foods, preserve them effectively, and apply appropriate sanitisation methods specific to each food type.

After the education activity is implemented, the prototype will be shown, and the possible questions will be answered. The evaluation method will be a Google Forms questionnaire, conducted with the people who work in the garden.

Figure 1: prototype with the plates of each food and the correct way of sanitising and storing

REFERENCES:

[1] Ministério da Saúde. "Como escolher, higienizar e armazenar frutas, verduras e legumes." [Online]. Available: https://www.gov.br/saude/pt-br/assuntos/saude-brasil/eu-quero-me-alimentar-melhor/noticias/2022/como-escolher-higienizar-e-armazenar-frutas-verduras-e-legumes. [Accessed: Jan. 14, 2025].

[2] Antigaspi. "Como conservar adequadamente as frutas?" [Online]. Available: https://antigaspi.lu/pt/foods/macas/. [Accessed: Jan. 14, 2025].

[3] El Ciruelo. "Dicas para conservar uvas por mais tempo." Aug. 18, 2023. [Online]. Available: https://www.elciruelo.com/pt-br/conservar-uvas/. [Accessed: Jan. 14, 2025].

[4] Pingo Doce. "Noz, a nutritiva." Nov. 15, 2016. [Online]. Available: https://www.pingodoce.pt/noz-a-nutritiva/#:~:text=Com%20casca%20as%20nozes%20conservam,basta%20congelá%2Dlas%20de%20antemão. [Accessed: Jan. 14, 2025].

[5] Alimentos Sem Mitos. "Pré-tratamento que confere 'aquela' textura à batata frita pode ser feito em casa." Jan. 23, 2020. [Online]. Available: https://alimentossemmitos.com.br/pre-tratamento-que-confere-aquela-textura-a-batata-frita-pode-ser-feito-em-casa. [Accessed: Jan. 14, 2025].

[6] Tribunal de Justiça de Santa Catarina. "Como conservar alguns alimentos por mais tempo - Parte 2." [Online]. Available: https://www.tjsc.jus.br/web/servidor/dicas-de-saude/-/asset_publisher/0rjJEBzj2Oes/content/como-conservar-alguns-alimentos-por-mais-tempo-parte-2. [Accessed: Jan. 14, 2025].

[7] M. Cardozo, "Dicas para fazer a cenoura durar mais tempo," Terra, Apr. 2, 2024. [Online]. Available: https://www.terra.com.br/vida-e-estilo/degusta/dicas-para-fazer-a-cenoura-durar-mais-tempo,a6f481b14b9fac4ffc5e77c622fbc39f6om4u9af.html. [Accessed: Jan. 14, 2025].

[8] PFARMA. "Como conservar alface por mais tempo em casa." [Online]. Available: https://pfarma.com.br/noticia-setor-farmaceutico/saude/8144-como-conservar-alface-por-mais-tempo-em-casa.html [Accessed: Jan. 14, 2025].

[9] Petitchef. "Posso congelar cenoura?" [Online]. Available: https://pt.petitchef.com/receitas/posso-congelar-cenoura-fid-512960. [Accessed: Jan. 14, 2025].

[10] Receitas Nestlé. "Como congelar couve?" [Online]. Available: https://www.receitasnestle.com.br/artigos/como-congelar-couve. [Accessed: Jan. 14, 2025].

[11] Plantte. "Como conservar couve na geladeira (Picada ou Inteira)." [Online]. Available: https://www.plantte.com/como-conservar-couve/. [Accessed: Jan. 14, 2025].

Natural Avocado Peel-Based Exfoliant

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Abstract

Avocados are a widely consumed fruit, with global production exceeding 6 million tons annually. However, this high demand generates significant waste, as the peels alone constitute around 15% of the fruit's total weight [1]. Rich in antioxidants and dietary fibres, avocado peels represent a substantial yet underutilised resource with great potential for valorisation.

In this work, avocado peels are transformed into a natural and sustainable skincare solution: an exfoliant branded as *BIOFLORNAV* (Figure 1). The natural properties of the peel make it ideal for removing dead skin cells and deeply cleansing pores, while also promoting skin renewal and improving texture.

Along with powdered avocado peel, the formulation includes almond oil for hydration, honey for its antibacterial properties, essential oils for preservation, and commercial fragrances—such as bamboo breeze, vanilla, or mixed scents—to enhance the overall experience. The result is a thick, luxurious paste that can be massaged onto the skin in circular motions, delivering a gentle yet revitalising exfoliation.

Avocado peel exfoliants offer a natural, sustainable, and affordable option for those looking to care for their skin efficiently and eco-consciously.

Figure 1: Logo (left) and final prototype (right) of the avocado peel-based exfoliant

REFERENCES

[1] Rojas-García, A.; Fuentes, E.; Cádiz-Gurrea, M.d.l.L.; Rodriguez, L.; Villegas-Aguilar, M.d.C.; Palomo, I.; Arráez-Román, D.; Segura-Carretero, A. Biological Evaluation of Avocado Residues as a Potential Source of Bioactive Compounds. Antioxidants 2022, 11, 1049. https://doi.org/10.3390/antiox11061049

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Nutritional Education in children - “A healthy day”

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Abstract

Nutritional intervention in children is essential because childhood is a crucial period for the development of healthy eating habits and prevention of chronic diseases such as obesity, which has increasingly increased at this age. Children spend a large part of their time at school, an environment that encompasses not only students, but also teachers, parents and the community, making it a strategic place to promote nutritional education. It is at this stage that food preferences are most likely to be shaped, and children must acquire skills to make informed food choices, especially in a social context where there is a large and easily accessible food supply and a strong influence of advertising. Furthermore, schools can act as a point of intervention to positively influence eating behaviour, helping children become more conscious consumers and prepared to make healthy eating decisions throughout their lives [1].

From this context, our project challenge with the name” A Healthy Day” was to create a set of nutritional education activities, such as interactive questions, videos and practical activities that aim to increase children's knowledge and autonomy in food choices. As a practical activity, we had to assemble the “healthy plate” (the prototype is below) and the “food traffic lights”, which consisted of classifying the foods into three different categories according to their consumption and recommendation.

The results were evaluated through the realisation of the practical activities and, in general, were positive; there was more interest than expected.

However, some of the challenges identified in implementing the activity were maintaining focus in some activities and changing children’s existing food preferences. It is hoped that in the future, there will be more food education projects, so that there can be more success and effectiveness in children's adherence to a healthy diet.

Figure 1: Prototype of a table tray for children to use at mealtimes

REFERENCES

[1] Santos B, Silva C, Pinto E. importância da escola na educação alimentar em crianças do primeiro ciclo do ensino básico – como ser mais eficaz. Acta Portuguesa de Nutrição.2018; Available from: https://actaportuguesadenutricao.pt/wp-content/uploads/2018/11/04_Import%C3%A2ncia-da-escola-na-educa%C3%A7%C3%A3o-alimentar-em-crian%C3%A7as-do-primeiro-ciclo-do-ensino-b%C3%A1sico-1.pdf

[2] Manual “Alimentação Saudável dos 0 aos 6 anos – Linhas de Orientação para Profissionais e Educadores” |Direção-Geral da Educação. www.dge.mec.pt. 2019. Available from: https://www.dge.mec.pt/noticias/manual-alimentacao-saudavel-dos-0-aos-6-anos-linhas-de-orientacao-para-profissionais-e

Projeto Integrado

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Introduction: The *Integrated Project* is a curricular unit from the final semester of the Multimedia undergraduate degree at EsACT. Its purpose is to consolidate and connect the various aspects of the programme, offering students a comprehensive understanding of multimedia and its practical application in real-world contexts. Additionally, this unit prepares students to work in multidisciplinary teams, conduct preliminary studies on real projects, and apply active methodologies in their planning and development. The aim is to strengthen the design and implementation of integrated multimedia products, ensuring their planning aligns with real-world briefs.
Objectives: The main goal of this curricular unit is to provide students with a practical and applied context in which to develop technical and creative skills, as well as deepen their knowledge through real project implementation. In 2024, two projects were undertaken: one for the *Associação Portuguesa do Direito do Consumo* (APDC – Portuguese Association for Consumer Law), and another for the *Cooperativa dos Produtores de Mel da Terra Quente e Frutos Secos* (CPMTQFS – Cooperative of Honey and Dried Fruit Producers of Terra Quente).
The first project involved the creation of a mobile app designed to assist consumers in understanding guarantees and related legislation. The second focused on developing the visual and audiovisual communication of the cooperative, while simultaneously identifying and strengthening its identity and digital presence.
Methodology: The methodology adopted varied according to the specific needs of each project. For the APDC, a user-centred approach was applied, following all UX and UI development stages and using the atomic design methodology. This process led to the creation of a high-fidelity prototype. In the CPMTQFS project, the strategy was centred on creating a communication plan that included a rebranding of the logo, social media management, product photography, and the production of promotional videos.
Results: A high-fidelity mobile app prototype was developed for the *Associação Portuguesa do Direito do Consumo*, providing consumers with a functional and accessible tool to promote literacy on guarantees and legal rights. In the case of CPMTQFS, audiovisual materials were produced in line with the communication plan, updating the cooperative's image and reinforcing its digital presence.
Conclusions: These projects demonstrate the value of learning through practice and the application of active methodologies in Multimedia education. They provided students with direct exposure to real-world challenges, enabling them to deepen both theoretical knowledge and technical expertise. Moreover, students developed essential interpersonal skills, such as teamwork, client communication, and adaptability to diverse realities.

Keywords: Active methodologies, atomic design, multimedia, audiovisual production, UX/UI, digital identity, IPB, EsACT

Removal of estrogens from water by adsorption using carbon-based materials

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Introduction: The removal of estrogens from water is an increasing concern in water treatment and environmental protection [1]. Both natural and synthetic estrogens are considered emerging contaminants, as they can disrupt the endocrine system of living organisms, even at very low concentrations [2]. These compounds enter water bodies through domestic and industrial waste, which traditional wastewater treatments often fail to remove effectively. This is due to their chemical properties, such as high resistance to degradation, lipophilicity, and high solubility. In response, adsorption using activated carbon has emerged as a promising method for removing such micropollutants. Activated carbon is highly effective due to its porous structure, large surface area, and high porosity. However, traditional activated carbon production is environmentally problematic, prompting the search for more sustainable and cost-effective alternatives. Agro-industrial waste, which contains a high carbon content, can be converted into activated carbon through physical and/or chemical activation. This process allows for the reuse of waste and reduces production costs and reliance on non-renewable resources.
Objectives: The main objective of this study is to prepare and characterise adsorbents derived from almond shells and cork for the removal of estrogens, including estrone (E1), 17β-estradiol (E2), estriol (E3), and 17α-ethinylestradiol (EE2) and to implement a methodology to analyse and quantify estrogens in aqueous matrices.
Methodology: Almond shells and cork provided by Portuguese industries' wastes were used as raw material to produce the adsorbents. The raw material, in powder form, was carbonised in the muffle at 550°C for 1h, and the carbonisation yield was calculated. The characterisation of adsorbents in terms of acidic and basic sites was done by putting a certain amount of adsorbent into NaOH and HCl solutions, respectively, and left to stir in an incubator at 20°C, 160 rpm and 24 hours. After this time, the remaining solutions were titrated with HCl or NaOH, and acidic and basic sites were determined. The pH at the point of zero charge, the pH value at which the total charge at the adsorbent´s surface is zero, was also determined. The quantification of estrogens was done by HPLC-DAD under the following conditions: flow rate of 1 mL/min, pressure at 122-144 atm, mobile phase 50:50 (V: V) water with acetonitrile, wavelength of 200 nm and a drag time of 15 min.
Results: The carbonisation process of the two materials had a yield of 22.3 ± 1.0% for the almond shell and 16.2 ± 2.1% for the cork. The number of acidic sites is far superior to basic sites, whether for raw almond shell (1356.40 ± 40.46 of acidic sites to 3.62 ± 0.06 of basic sites) or raw cork (1424.12 ± 41.60 of acidic sites to 29.33 ± 0.16 of basic sites). The number of acidic sites drastically reduces with carbonisation, while the number of basic sites increases significantly, with carbonised almond shell having 25.98 ± 0.01 acidic sites and 383.00 ± 38.19 basic sites and carbonised cork with 115.46 ± 0.73 acidic sites and 411.25 ± 0.29 basic sites. The pH_{PZC} of the almond shell carbon is 6.72 ± 0.04. The calibration curves for the three estrogens were obtained using HPLC-DAD methodology.
Conclusions: This work presents the initial steps in the characterisation of activated carbon derived from biomass materials. HPLC-DAD proves to be an efficient method to quantify extremely small concentrations of estrogens due to their distinct retention time. It was found that the carbonisation yield was higher for almond shells. The pH_{PZC} value proves that both adsorbents are neutral. The continuity of this work encompasses the characterisation of activated carbons by FTIR and the carrying out of isotherm and adsorption studies.

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Keywords: Emerging contaminants, estrogens, activated carbon, biomass

REFERENCES:

[1] Machineni L (2019),” Review on biological wastewater treatment and resources recovery: Attached and suspended growth systems.”

[2] Kim MK, Zoh KD (2016) “Occurrence and removal of micropollutants in water environment.”

The Shades of Nature: Dye or Try

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The demand for natural dyes is rising due to their eco-friendly nature and recyclability. Our product, *The Shades of Nature: Dye or Try*, repurposes vegetable food industry byproducts to create vibrant, synthetic-like colours while reducing chemicals, minimising allergens, and promoting sustainability.
Peels from red cabbage, onion, and beetroot were collected, dried, and ground into fine powder to dye cotton fabric pre-treated with tannic acid as a mordant. Fabrics were dyed in water baths with varying powder concentrations and agitation times. Additional colours were obtained by adjusting red cabbage dye pH using HCl and NaOH.
The experiment revealed that colour outcomes depend on peel powder concentration, pH, and dyeing time (Figure 1). Beetroot and onion skin dyes consistently produce brownish/orangish tones at neutral pH (~6). Red cabbage dyes are pH-sensitive: alkaline (NaOH, pH ~7–8) creates blue/green tones, acidic (HCl, pH ~0–1) gives pink/red tones, and neutral (~6–7) results in purple/blue. A 10% dye-to-weight-of-cloth (WOC) ratio in 200 ml water (90 min) yields pale pastels, while a 25% ratio in 150 ml water (30, 60, and 120 min) produces intense, vibrant shades. Residue on fabrics highlights the need for better filtration and pre-treatment. Unmordanted and unheated samples dyed for 60 minutes further emphasise pH's impact on colour.
Biodegradable and safe for ecosystems, natural dyes offer substantial environmental advantages over synthetic dyes, which release toxins and alter wastewater pH.

Figure 1: Logo (left) and final prototype (right) of the dying cotton

REFERENCES

[1] Radhakrishnan, S., Rajangam, R., & Peruran, P. (2024). Social and environmental impact of natural dyeing. In S. S. Muthu (Ed.), Natural dyes and sustainability (pp. 127–152). Springer.
[2] Ahmedabad Textile Industry's Research Association. (2023, January 20). Why are natural dyes important? (Detailed guide). ATIRA.

This work was part of the 'Chemistry Project' course in the Chemical Engineering Bachelor's program at the Polytechnic Institute of Bragança (2024/2025), focusing on valorising food industry by-products.

Tomato Skin-Based Moisturising Cream

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Tomatoes are a widely consumed fruit known for their rich composition of lycopene, vitamins A and C, and essential minerals, which act as antioxidants and moisturisers, promoting cell regeneration and improving skin luminosity. However, tomato processing generates significant waste, with peels constituting a substantial by-product. Globally, millions of tons of tomato waste are produced annually, highlighting the need for sustainable strategies to repurpose this resource [1].

Tomato peels, which retain the bioactive properties of the fruit, can be utilised in cosmetic formulations, offering a sustainable and eco-efficient solution for skincare [2]. Their use in moisturising creams not only aligns with the principles of sustainability but also leverages the natural benefits of tomatoes for skin hydration and protection.

This study aimed to explore the use of tomato peels as a natural ingredient in a moisturising cream branded as *Akuitikile* (Figure 1). The peels were collected, dried, and incorporated at varying concentrations into an oil-in-water emulsion. Terpenes were added to the formulation to ensure microbiological stability. The formulations were evaluated for stability and pH, and the product was tested on human volunteers. Additionally, a survey was conducted to assess user satisfaction and the effectiveness of the product. The results demonstrate the feasibility of repurposing tomato peels for cosmetic applications, combining environmental responsibility with benefits for skin health.

Figure 1: Logo (left) and final prototype (right) of the tomato skin-based moisturising cream.

REFERENCES

[1] Viuda-Martos, M., Sanchez-Zapata, E., Sayas-Barberá, E., Sendra, E., Pérez-Álvarez, J. A., & Fernández-López, J. (2014). Tomato and Tomato Byproducts. Human Health Benefits of Lycopene and Its Application to Meat Products: A Review. Critical Reviews in Food Science and Nutrition, 54(8), 1032–1049. https://doi.org/10.1080/10408398.2011.623799

[2] Szabo, K., Cătoi, AF. & Vodnar, D.C. Bioactive Compounds Extracted from Tomato Processing by-Products as a Source of Valuable Nutrients. Plant Foods Hum Nutr 73, 268–277 (2018). https://doi.org/10.1007/s11130-018-0691-0

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