Vocational qualification programme: Light Pollution Mitigation Specialist

Table of Contents

Table of Contents

Table of Contents

Table of Contents

About the project

Eco Lumen is a bold, 24-month initiative funded by the European Education and Culture Executive Agency (EACEA), with Youth Power Germany e.V. in partnership with institutions from Croatia, Estonia, Colombia, and Chile, the project unites diverse expertise to tackle the critical issue of light pollution across Europe and Latin America.

At its heart, Eco Lumen aims to develop a specialized vocational curriculum for Light Pollution Mitigation Specialists — professionals equipped with both green and digital skills to meet the evolving demands of the modern labor market and contribute to sustainable practices in lighting.

Key elements of the project include:
- Cross-Cultural Collaboration — fostering the exchange of best practices and sustainable lighting solutions across the EU and Latin America.
- Advocacy & Policy Support — raising awareness about light pollution and promoting supportive policy frameworks.
- Digital Innovation — delivering the curriculum via flexible digital platforms to enhance accessibility and scalability.
- Professional Empowerment — offering hands-on pilot trainings and modular learning tools for educators and learners to bridge theoretical and practical knowledge.
- Transformation of VET Curricula — embedding energy-efficiency and renewable technology principles into vocational education in line with global and European sustainability targets.
- Multi-Stakeholder Engagement — fostering partnerships among VET providers, policymakers, and the renewable energy sector to expand educational and employment opportunities.
- Learner Empowerment — equipping students with market-relevant skills to thrive in green energy industries.

About the project

Expected outcomes include enhanced VET learner employability through industry-aligned competence, increased adoption of sustainable lighting practices in communities and institutions, and strengthened collaboration networks across education, policy, and industry sectors.

Aligning strongly with the Erasmus+ objectives of inclusion, diversity, digital transformation, and international cooperation, Eco Lumen promotes sustainable urban development, environmental well-being, and opens new vocational pathways in a growing green field.

Introduction about the program

The curriculum for obtaining the qualification Specialist in Light Pollution Mitigation represents a vocational education and training (VET) initiative developed to address the growing global challenge of light pollution in various regions, including Europe and Latin America. This comprehensive curriculum is designed to equip individuals with the knowledge, practical skills, and tools required to effectively identify, assess, and mitigate the effects of artificial light at night.

This curriculum aims to develop capable individuals in light pollution mitigation by providing them with in-depth expertise in light management. Through its structured learning approach, it prepares learners for roles within diverse urban environments and the labor market, where sustainable lighting practices are increasingly in demand. The entire curriculum spans 29 hours and its pedagogical framework integrates theoretical foundations, guided and work-based learning, and independent study, ensuring a well-rounded and practical educational experience across its four main modules and an introductory module.

The VET EcoLume project, through this curriculum, employs a strategic, multifaceted approach, contributing to three key areas:

- Education: This curriculum provides VET learners with knowledge and practical skills tailored to address the complexities of light pollution, fostering competencies in areas like lighting design, energy efficiency, environmental impact assessment, and regulatory compliance.
- Collaboration: By facilitating the exchange of best practices and current knowledge on sustainable lighting solutions, the curriculum supports cross-cultural collaboration between countries in the EU and Latin America.
- Advocacy: The training enables individuals to raise awareness about the importance of light pollution mitigation, thereby promoting policies and regulations that support environmentally friendly lighting practices.

Ultimately, by integrating these fundamental pillars, this curriculum contributes to the VET EcoLume project's broader mission: not only to address the challenges presented by light pollution but also to contribute to sustainable urban development and overall environmental well-being, fostering a more balanced coexistence between human activities and the natural nocturnal environment. It is a basis for building institutional and community capacities for effective light management.

Theoretical Introduction to the VET EcoLume Curriculum

Introduction to Light and Light Pollution

The Nature of Light and its Anthropogenic Evolution

Light, fundamentally, is electromagnetic radiation, a form of energy that propagates through space as both a wave and a particle. Its interaction with matter underpins all visual perception and a vast array of natural processes. From a human perspective, the harnessing of light has been a defining characteristic of technological and societal advancement. The evolution of artificial lighting, from rudimentary fire to sophisticated solid-state lighting (SSL) technologies like Light Emitting Diodes (LEDs), marks a profound shift in human interaction with the nocturnal environment.

Early artificial light sources, such as fire and oil lamps, provided localized illumination, primarily for safety and extended activity within limited confines. Their environmental footprint was negligible on a global scale. The advent of gas lighting in the 19th century and incandescent electric lighting in the 20th century initiated a more widespread transformation of the night, extending human activity beyond daylight hours and fundamentally altering urban landscapes. However, these technologies, while revolutionary, were relatively inefficient and often produced light with broad spectral distributions, including significant infrared and ultraviolet components.

The contemporary era is dominated by LEDs, which represent a paradigm shift in lighting technology. LEDs offer unparalleled energy efficiency, longevity, and control over spectral output. This efficiency, however, has inadvertently contributed to a phenomenon known as the 'rebound effect,' where the reduced cost of illumination leads to increased overall light usage, exacerbating light pollution. The spectral characteristics of LEDs are particularly pertinent; many white LEDs achieve their white light by combining a blue LED with a yellow phosphor. This results in a significant emission peak in the blue portion of the visible spectrum. This blue-rich light has been implicated in various environmental and health concerns, as discussed below.

Understanding light also necessitates a grasp of its fundamental properties and measurement. The light spectrum refers to the range of wavelengths of electromagnetic radiation that are visible to the human eye. Different wavelengths are perceived as different colors. The presence of a strong blue component in LED lighting is a critical factor in its environmental and biological impacts. Key units of light measurement include:

- **Lumen (lm):** A measure of the total amount of visible light emitted by a source.
- **Lux (lx):** A measure of illuminance, or the amount of light falling on a surface. One lux is equal to one lumen per square meter.
- **Candela (cd):** A measure of luminous intensity in a given direction.
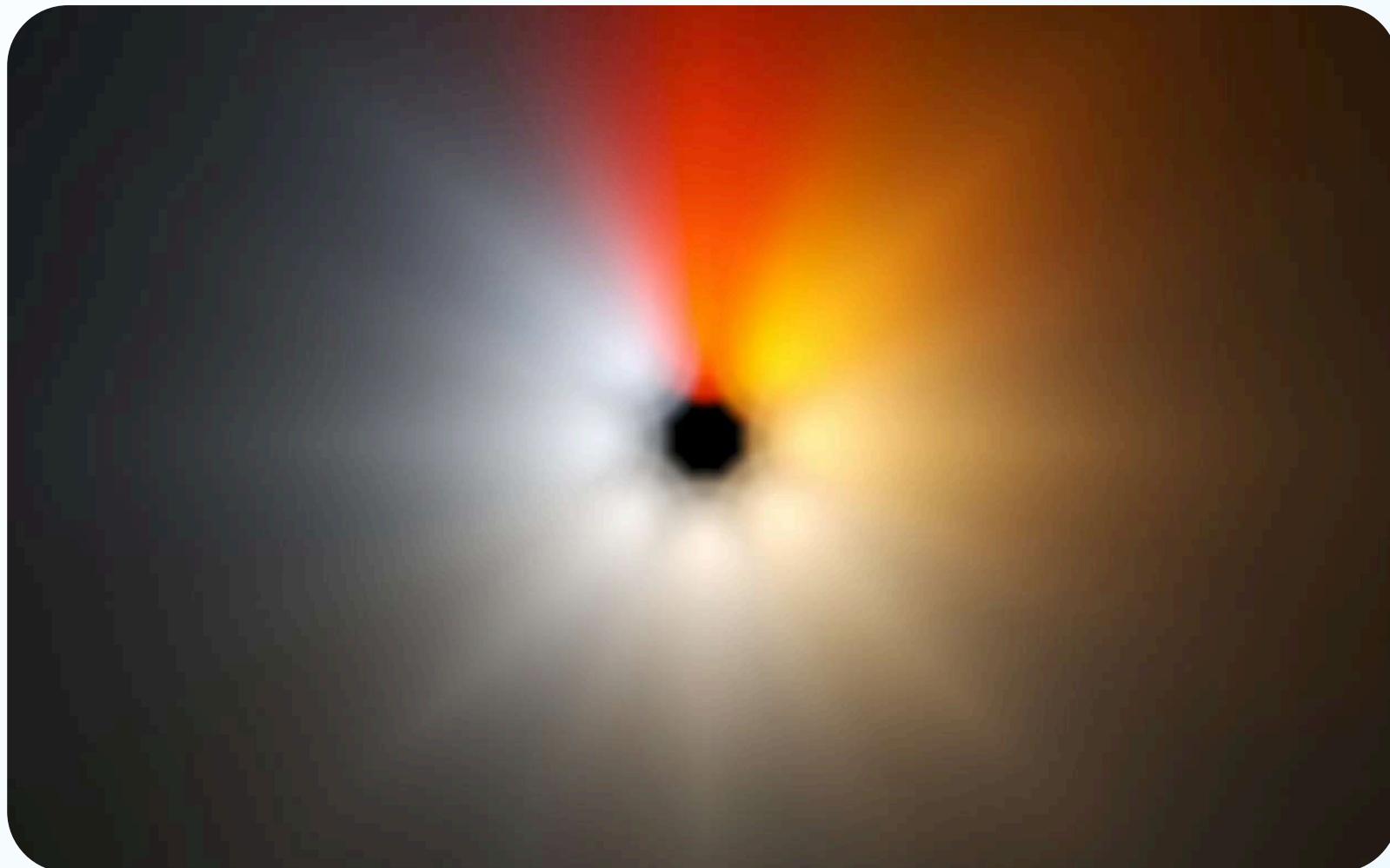
Correlated Color Temperature (CCT), measured in Kelvin (K), describes the perceived color of light emitted by a source. Lower CCT values (e.g., 2700K-3000K) correspond to 'warm' light, which appears yellowish or reddish, similar to incandescent bulbs. Higher CCT values (e.g., 4000K-6500K) correspond to 'cool' light, which appears bluer or whiter.

The choice of CCT has significant implications for both human comfort and ecological impact, with warmer temperatures generally preferred for human environments and cooler temperatures often associated with increased light pollution due to their higher blue light content.

The Multifaceted Challenge of Light Pollution

Light pollution is defined as the excessive, misdirected, or obtrusive use of artificial light at night (ALAN). It is a pervasive form of environmental degradation that disrupts natural darkness and has far-reaching consequences. While artificial light has brought undeniable benefits, its uncontrolled proliferation has led to several distinct forms of pollution:

- **Skyglow:** This is the most widespread and visually striking manifestation of light pollution, characterized by the brightening of the night sky over inhabited areas. It results from artificial light being emitted upwards, where it is scattered by atmospheric particles and gases, creating a luminous dome. Skyglow obscures celestial objects, impacting astronomical research and cultural heritage. Factors such as cloud cover and snow can exacerbate skyglow by reflecting light back towards the ground, intensifying its effect.
- **Light Trespass:** This occurs when unwanted light from one property spills onto another, causing nuisance or intrusion. Examples include streetlights shining into bedrooms or commercial lighting illuminating residential areas. It can lead to sleep disturbances and a loss of privacy.
- **Glare:** Defined as excessive brightness that causes visual discomfort or reduces visibility. Disabling glare can temporarily blind drivers or pedestrians, increasing the risk of accidents. Modern LED lighting, with its high intensity and often narrow beam angles, can be particularly prone to causing glare.

These forms of light pollution are not merely aesthetic concerns; they have profound impacts on human health. Exposure to ALAN, particularly blue-rich light, can disrupt the human circadian system, the internal biological clock that regulates sleep-wake cycles and various physiological processes. This disruption can suppress the production of melatonin, a hormone crucial for regulating sleep, and has been linked to an increased risk of sleep disorders, obesity, certain cancers (e.g., breast and prostate), and mental health issues like depression. The sensitivity of the human eye to blue light at night, and its strong influence on melatonin suppression, makes the spectral composition of artificial light a critical consideration for public health.

The environmental impacts of ALAN are equally significant. Nocturnal ecosystems are particularly vulnerable. Artificial light can disorient migratory birds, disrupt the foraging and reproductive behaviors of insects, bats, and other nocturnal animals, and alter predator-prey dynamics. For instance, sea turtle hatchlings, which naturally navigate towards the brighter horizon of the ocean, can become disoriented by coastal lighting and move inland, increasing their mortality. The disruption of natural light cycles can also affect plant physiology and phenology, with cascading effects throughout ecosystems. ALAN is increasingly recognized as a global threat to biodiversity, contributing to insect declines and habitat fragmentation.

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To mitigate these adverse effects, the principles of sustainable lighting are paramount:

- **Usefulness:** Light should only be used where and when it is genuinely needed, avoiding unnecessary illumination.
- **Direction:** Light should be precisely directed downwards, preventing upward light spill (full cut-off luminaires) and minimizing light trespass.
- **Control:** The use of smart lighting systems, including sensors (motion, daylight) and dimmers, allows for dynamic adjustment of light levels based on real-time needs, reducing energy consumption and light pollution.
- **Intensity:** Over-illumination should be avoided. The appropriate light level should be determined based on the specific task or area being illuminated, rather than simply maximizing brightness.
- **Color:** Prioritizing warmer color temperatures (lower CCT) for outdoor lighting, especially in ecologically sensitive areas, can reduce the blue light component that is most disruptive to wildlife and human circadian rhythms.

These principles form the foundation for responsible lighting practices, aiming to balance human needs for illumination with the imperative to protect the natural night environment and human health. The transition to sustainable lighting requires a holistic approach, integrating technological solutions with ecological understanding and public awareness.

Environmental and Health Impact Assessment of Light Pollution

Assessing Environmental Sensitivity to Light Pollution

The impact of artificial light at night is not uniform across all environments. Different ecosystems and land uses exhibit varying degrees of sensitivity to light pollution, necessitating a nuanced approach to impact assessment and mitigation. The classification of environmental sensitivity is a crucial first step in developing effective lighting strategies. Key factors influencing sensitivity include:

- **Ecological Integrity:** Areas with high ecological integrity, such as national parks, nature reserves, and biodiversity hotspots, are particularly sensitive to light pollution. These areas often harbor species that are highly adapted to nocturnal conditions and are thus vulnerable to disruptions in natural light cycles.
- **Presence of Nocturnal Species:** The presence of nocturnal or crepuscular species, including bats, owls, insects, and amphibians, is a primary indicator of environmental sensitivity. These species rely on darkness for foraging, reproduction, and avoiding predation. ALAN can disrupt these behaviors, leading to population declines and ecosystem imbalances.
- **Astronomical Significance:** Locations with dark skies, such as astronomical observatories and dark sky parks, are highly sensitive to light pollution. Skyglow from distant urban areas can severely compromise astronomical research and public enjoyment of the night sky.
- **Human Habitation:** Residential areas are also considered sensitive environments, as light trespass and glare can impact human health and well-being, leading to sleep disturbances and reduced quality of life.
- **Agricultural Land:** While often overlooked, agricultural areas can also be sensitive to light pollution. ALAN can affect the behavior of pollinators, disrupt the growth cycles of crops, and alter the behavior of pests and their natural predators.

Understanding these varying degrees of sensitivity allows for the development of targeted lighting guidelines and regulations. For example, stricter lighting controls, including lower light levels, warmer color temperatures, and full cut-off luminaires, are often recommended for highly sensitive areas.

Tools and Methodologies for Light Pollution Assessment

A comprehensive assessment of light pollution requires a combination of qualitative and quantitative methods. Various tools and methodologies have been developed to diagnose, monitor, and evaluate the extent and impact of ALAN:

- **Field Surveys and Audits:** Direct observation and measurement of light sources in the field are essential for a detailed assessment. This can involve mapping the location and characteristics of luminaires, measuring light levels (lux), and assessing glare. Participatory approaches, such as "light pollution walks," can engage community members in identifying problematic lighting and raising awareness.
- **Leopold Matrix:** The Leopold Matrix is a widely used tool for environmental impact assessment. It can be adapted to evaluate the impacts of light pollution by creating a matrix that links specific light sources (e.g., streetlights, building facades, advertising signs) to potential environmental and social impacts (e.g., disruption of wildlife, sleep disturbance, energy waste). This provides a systematic framework for identifying and prioritizing impacts.
- **Remote Sensing and Satellite Data:** Satellite imagery provides a large-scale perspective on light pollution, allowing for the mapping and monitoring of skyglow over time. Data from satellites such as the Defense Meteorological Satellite Program (DMSP) and the Visible Infrared Imaging Radiometer Suite (VIIRS) have been instrumental in tracking the global spread of light pollution. These data can be used to identify hotspots, assess the effectiveness of mitigation measures, and model the propagation of light pollution.
- **Sky Quality Meters (SQMs):** These are handheld devices that measure the brightness of the night sky, providing a quantitative measure of skyglow. SQMs are widely used by astronomers, researchers, and citizen scientists to monitor changes in sky quality and assess the impact of light pollution on the visibility of stars.
- **Mobile Applications:** A growing number of mobile applications allow citizen scientists to contribute to light pollution monitoring. These apps typically use the phone's camera to measure sky brightness or allow users to report observations of the night sky. While less precise than dedicated instruments, they provide a valuable source of crowdsourced data.

The Impact of Screen Time on Human Health

In addition to outdoor lighting, indoor sources of artificial light, particularly from electronic screens, have become a significant concern for human health. The proliferation of smartphones, tablets, computers, and televisions has led to a dramatic increase in screen time, with profound implications for sleep, vision, and mental well-being. The primary mechanism through which screen time affects health is the disruption of the circadian system. The blue-rich light emitted by most electronic screens is particularly effective at suppressing melatonin production, the hormone that regulates sleep. Exposure to screens in the hours before bedtime can delay the onset of sleep, reduce sleep quality, and lead to a state of chronic sleep deprivation. This can have cascading effects on cognitive function, mood, and physical health, increasing the risk of obesity, diabetes, and cardiovascular disease.

Beyond sleep disruption, excessive screen time can also lead to digital eye strain, characterized by symptoms such as dry eyes, headaches, and blurred vision. The high-energy blue light emitted by screens can also contribute to long-term damage to the retina. Furthermore, the content consumed on screens, particularly social media and news, can contribute to anxiety, depression, and other mental health issues.

To mitigate these risks, it is recommended to:
- **Limit screen time, especially in the evening:** Avoid using screens for at least an hour before bedtime.
- **Use blue light filters:** Many devices now offer a "night mode" or blue light filtering apps that reduce the amount of blue light emitted by the screen.
- **Practice good sleep hygiene:** Maintain a regular sleep schedule, create a relaxing bedtime routine, and ensure the bedroom is dark, quiet, and cool.
- **Take regular breaks from screens:** Follow the 20-20-20 rule: every 20 minutes, look at something 20 feet away for 20 seconds.

The Central Role of Circadian Rhythms

The circadian rhythm is a fundamental biological process that governs the daily cycles of nearly all living organisms, from bacteria to humans. This internal clock, which has a period of approximately 24 hours, is synchronized with the external environment primarily by the daily cycle of light and darkness. The master clock in mammals is located in the suprachiasmatic nucleus (SCN) of the hypothalamus, which receives direct input from the retina.

The circadian system regulates a wide range of physiological and behavioral processes, including:
- **Sleep-wake cycles:** The most obvious manifestation of the circadian rhythm.
- **Hormone secretion:** The rhythmic release of hormones such as melatonin and cortisol.
- **Body temperature:** The daily fluctuation in core body temperature.
- **Metabolism:** The regulation of glucose and lipid metabolism.
- **Cognitive function:** The daily variation in alertness, attention, and memory.

Disruption of the circadian rhythm, whether through exposure to ALAN, shift work, or jet lag, can have significant health consequences. Chronic circadian disruption is associated with an increased risk of a wide range of diseases, including sleep disorders, metabolic syndrome, cardiovascular disease, and cancer. The modern 24/7 society, with its constant exposure to artificial light, poses a significant challenge to the maintenance of a healthy circadian rhythm.

Maintaining a robust circadian rhythm is essential for overall health and well-being. This can be achieved by:

- **Maximizing exposure to natural daylight, especially in the morning:** This helps to synchronize the internal clock with the external environment.
- **Minimizing exposure to artificial light, especially blue-rich light, at night:** This allows for the natural rise in melatonin and the onset of sleep.
- **Maintaining a regular sleep-wake schedule:** Going to bed and waking up at the same time each day, even on weekends, helps to stabilize the circadian rhythm.
- **Timing meals and exercise:** Eating and exercising at regular times each day can also help to reinforce the circadian rhythm.

In conclusion, the assessment of environmental and health impacts of light pollution requires a multi-faceted approach, encompassing the classification of environmental sensitivity, the use of diverse assessment tools, an understanding of the specific risks posed by screen time, and a deep appreciation for the central role of circadian rhythms in maintaining health. By integrating these perspectives, we can develop more effective strategies for mitigating the adverse effects of ALAN and promoting a healthier relationship with light.

Technical Solutions and Design of Sustainable Nightlife Spaces

The Emergence of Lighting Urbanism and the Urban Lighting Plan

The concept of lighting urbanism represents a significant evolution in the field of urban design, moving beyond purely functional considerations of illumination to a more holistic and human-centric approach. It recognizes that light is not merely a technical utility but a powerful tool for shaping the nocturnal identity of a city, enhancing public life, and fostering a sense of place. Lighting urbanism integrates the design of the nocturnal landscape with broader urban planning goals, considering the social, cultural, economic, and environmental dimensions of light.

At the heart of lighting urbanism is the Urban Lighting Plan (ULP), a strategic document that guides the development and management of a city's lighting infrastructure. A ULP is not simply a technical manual for street lighting; it is a comprehensive vision for the nocturnal city, developed through a collaborative process involving urban planners, lighting designers, architects, landscape architects, environmental experts, and the public. The key objectives of a ULP typically include:

- **Creating a Coherent Nocturnal Identity:** A ULP aims to create a unique and memorable nocturnal identity for the city, highlighting its architectural heritage, cultural landmarks, and public spaces.
- **Enhancing Public Safety and Security:** While acknowledging that more light does not necessarily equal more safety, a ULP seeks to improve perceived and actual safety through the strategic use of light, reducing fear of crime and encouraging pedestrian activity.
- **Promoting Nightlife and the Nocturnal Economy:** By creating attractive and inviting nocturnal environments, a ULP can stimulate the evening and nighttime economy, supporting restaurants, cafes, theaters, and other cultural venues.
- **Protecting the Environment and Human Health:** A central tenet of a ULP is the mitigation of light pollution. This is achieved through the implementation of sustainable lighting principles, such as the use of full cut-off luminaires, appropriate light levels, warmer color temperatures, and smart lighting controls.
- **Improving Energy Efficiency:** A ULP promotes the use of energy-efficient lighting technologies, such as LEDs, and smart lighting systems to reduce energy consumption and greenhouse gas emissions.

The development of a ULP typically involves several key steps:

- **Diagnosis and Analysis:** A thorough assessment of the existing lighting conditions, including a mapping of light levels, an inventory of luminaires, and an analysis of the city's nocturnal activities and user needs.
- **Vision and Objectives:** The development of a clear vision for the nocturnal city and a set of specific, measurable, achievable, relevant, and time-bound (SMART) objectives.
- **Lighting Masterplan:** The creation of a detailed masterplan that specifies lighting strategies for different areas of the city, including streets, parks, public squares, building facades, and monuments.
- **Implementation and Management:** The development of a plan for the implementation of the ULP, including a timeline, budget, and a framework for ongoing management and maintenance.

Cities like Lyon, France, have been pioneers in the field of lighting urbanism, demonstrating how a strategic approach to lighting can transform the nocturnal experience of a city, creating a vibrant and attractive urban environment while minimizing environmental impact.

A Typology of Urban Lighting

Urban lighting can be categorized into several distinct types, each with its own function and design considerations:

- **Functional Lighting:** This is the most common type of urban lighting, primarily concerned with illuminating streets, roads, and other transportation corridors to ensure the safety and security of drivers, pedestrians, and cyclists. The design of functional lighting is typically governed by technical standards that specify minimum light levels, uniformity, and glare control.
- **Architectural and Monumental Lighting:** This type of lighting is used to accentuate the architectural features of buildings, monuments, and other structures, enhancing their aesthetic appeal and creating a sense of place. The design of architectural lighting requires a careful balance between artistic expression and the need to avoid light pollution and respect the historical integrity of the structure.
- **Green Structure Lighting:** This refers to the lighting of parks, gardens, and other green spaces. The design of green structure lighting must be particularly sensitive to the needs of wildlife, using low light levels, warm color temperatures, and shielding to minimize ecological disruption.
- **Light Art:** This involves the use of light as an artistic medium to create temporary or permanent installations that engage the public and animate public spaces. Light art can be a powerful tool for urban revitalization, transforming underutilized or unsafe areas into vibrant cultural destinations.

The Social and Cultural Dimensions of Lighting Urbanism

Lighting urbanism recognizes that light is not just a physical phenomenon but also a social and cultural one. The way we light our cities reflects our values, priorities, and aspirations. A human-centric approach to lighting design considers the diverse needs and perceptions of different user groups, including children, the elderly, and people with disabilities. Public participation is a crucial component of lighting urbanism. Engaging residents in the design process can help to ensure that lighting solutions are responsive to local needs and preferences, fostering a sense of ownership and pride in the nocturnal environment. This can be achieved through workshops, surveys, and other forms of community engagement.

From Diagnosis to Intervention: The Urban Lighting Plan in Practice

The practical implementation of an Urban Lighting Plan involves a cyclical process of diagnosis, design, and evaluation. The initial diagnosis, as described above, provides the baseline data for the design phase. The design phase involves the development of specific lighting solutions for different areas of the city, based on the principles of sustainable lighting and the objectives of the ULP.

Innovative approaches, such as "Urban Lighting Acupuncture," can be used to target specific areas for intervention. This involves small-scale, strategic lighting projects that can have a significant impact on the quality of the nocturnal environment. These projects can serve as pilot studies, demonstrating the benefits of sustainable lighting and building support for larger-scale initiatives.

Light Art projects can also be a powerful tool for intervention, using light to address social or spatial challenges. For example, a light art installation could be used to improve the perceived safety of a dark underpass or to create a new focal point for a neglected public square.

In conclusion, the design of sustainable nightlife spaces requires a comprehensive and integrated approach, grounded in the principles of lighting urbanism. By developing and implementing Urban Lighting Plans, cities can create nocturnal environments that are safe, attractive, and environmentally responsible, enhancing the quality of life for all residents.

Community Action and Multi-Level Governance
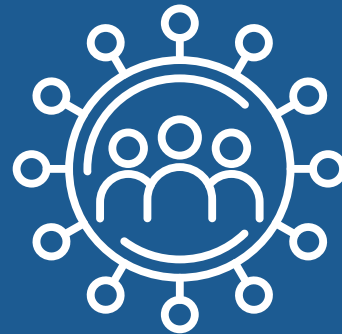
The Imperative of Collective Action in Addressing Light Pollution

Addressing the pervasive challenge of light pollution necessitates a multi-faceted approach that extends beyond technical solutions to encompass robust community engagement, effective communication strategies, and sophisticated multi-level governance frameworks. The efficacy of any mitigation effort is profoundly influenced by the capacity for collective action, wherein diverse stakeholders coalesce around a shared understanding of the problem and a commitment to its resolution. This module delves into the theoretical underpinnings and practical modalities through which communities can mobilize, communicate, and govern to foster sustainable nocturnal environments.

Strategic Communication for Environmental Advocacy

Effective communication is paramount in translating complex scientific and environmental issues, such as light pollution, into actionable public understanding and policy. The development of communication campaigns in this domain requires a strategic approach that transcends mere information dissemination to engage, persuade, and mobilize target audiences. A key principle in this endeavor is the adoption of "plain language" – the art of conveying intricate concepts in a clear, concise, and accessible manner, thereby bridging the gap between expert knowledge and public comprehension. This involves de-jargonizing technical terms, utilizing relatable analogies, and framing the issue within the lived experiences of the audience.

Successful communication campaigns are typically structured around several core components:

1. **Audience Analysis:** Identifying the target audience and understanding their existing knowledge, attitudes, and values regarding light pollution.
2. **Message Framing:** Crafting compelling narratives that resonate with the audience, highlighting the impacts of light pollution on human health, biodiversity, energy consumption, and cultural heritage.
3. **Channel Selection:** Utilizing appropriate communication channels, ranging from traditional media (e.g., public service announcements, print articles) to digital platforms (e.g., social media, interactive websites) and community outreach events.
4. **Call to Action:** Clearly articulating desired behaviors or policy changes, empowering individuals and communities to participate in mitigation efforts.
5. **Evaluation:** Continuously assessing the effectiveness of the campaign and adapting strategies based on feedback and outcomes.

Illustrative examples of impactful communication campaigns in the realm of light pollution include initiatives that leverage citizen science platforms to engage the public in data collection, educational programs that demystify the science of light, and advocacy groups that utilize creative storytelling to highlight the beauty and importance of dark skies. These campaigns often demonstrate that the most effective communication is not about overwhelming the audience with facts, but about fostering an emotional connection and a sense of shared responsibility.

Governance and the Architecture of Nocturnal Management

Effective governance is critical for addressing light pollution, as it involves coordinating the actions of multiple stakeholders across various jurisdictional levels. The concept of nocturnal governance recognizes that the management of the night environment requires a holistic approach that integrates urban planning, public health, environmental protection, and economic development. This necessitates the identification and empowerment of key roles and actors within the governance structure.

Typical roles involved in nocturnal governance may include:
- **Night Mayors/Coordinators:** Dedicated municipal officials responsible for overseeing and coordinating nocturnal activities, balancing economic development with social and environmental considerations.
- **Astronomical Agencies and Observatories:** Providing scientific expertise on the impacts of light pollution on astronomical research and advocating for dark sky preservation.
- **Lighting Designers and Engineers:** Contributing technical expertise in designing and implementing sustainable lighting solutions.
- **Environmental and Conservation Organizations:** Advocating for the protection of nocturnal ecosystems and biodiversity.
- **Community Leaders and Associations:** Representing the interests of residents and mobilizing local action.

Examples of successful nocturnal governance models include the establishment of dedicated dark sky reserves and parks, the implementation of comprehensive lighting ordinances, and the formation of multi-stakeholder committees to develop and oversee light pollution mitigation strategies. These initiatives often demonstrate the importance of collaborative decision-making, transparent processes, and adaptive management in achieving sustainable outcomes.

Structuring Proposals for Light Pollution Mitigation

Translating the understanding of light pollution and its governance into tangible action requires the ability to formulate compelling proposals for intervention. Whether advocating for policy changes, seeking funding for projects, or initiating community-based initiatives, a well-structured proposal is essential for securing support and resources. Key elements of an effective proposal typically include:

1. **Problem Statement:** Clearly articulating the specific light pollution issue being addressed, its impacts, and the urgency of intervention.
2. **Goals and Objectives:** Defining the desired outcomes of the proposed intervention, ensuring they are specific, measurable, achievable, relevant, and time-bound.
3. **Proposed Activities:** Detailing the specific actions that will be undertaken to address the problem, including methodologies, timelines, and resource requirements.
4. **Expected Outcomes and Impacts:** Describing the anticipated benefits of the intervention, both in terms of direct results and broader societal or environmental improvements.
5. **Budget and Resources:** Outlining the financial and human resources required for implementation.
6. **Monitoring and Evaluation:** Establishing a framework for tracking progress, measuring success, and ensuring accountability.

Examples of successful instruments for light pollution mitigation include comprehensive lighting regulations enacted by municipalities, open competitions that incentivize innovative lighting designs, and community-led projects focused on retrofitting existing lighting infrastructure with dark-sky friendly alternatives. The documentation and dissemination of these processes, results, and lessons learned are crucial for fostering knowledge exchange and replicating successful interventions.

The Art of the Assertive Pitch: Public Narrative and Advocacy

Effective advocacy for light pollution mitigation often culminates in the ability to deliver a compelling and assertive pitch that inspires action and galvanizes support. The Public Narrative framework, developed by Professor Marshall Ganz, provides a powerful pedagogical tool for cultivating leadership and mobilizing communities around shared purposes. This framework emphasizes the interconnectedness of three distinct narratives:

- **Story of Self:** This narrative explores the personal experiences, values, and motivations that compel an individual to engage in a particular cause. It answers the question: "Why am I called to lead?" By sharing personal vulnerability and conviction, the storyteller builds empathy and connection with the audience.
- **Story of Us:** This narrative articulates the shared values, experiences, and aspirations that bind a community or group together. It answers the question: "What is our shared purpose?" By highlighting collective identity and common challenges, the storyteller fosters a sense of solidarity and mutual commitment.
- **Story of Now:** This narrative identifies the urgent challenge or opportunity that demands immediate action. It answers the question: "Why must we act now?" By framing the present moment as a critical juncture, the storyteller creates a sense of urgency and inspires a call to action.

The power of the Public Narrative lies in its ability to weave these three stories into a cohesive and emotionally resonant appeal. By connecting personal experience to collective identity and then to an urgent call for action, advocates can effectively communicate the stakes of light pollution, articulate a compelling vision for a darker, healthier night, and mobilize diverse constituencies to contribute to its realization. This approach transcends purely rational arguments, tapping into the deeper wellsprings of human motivation and collective agency.
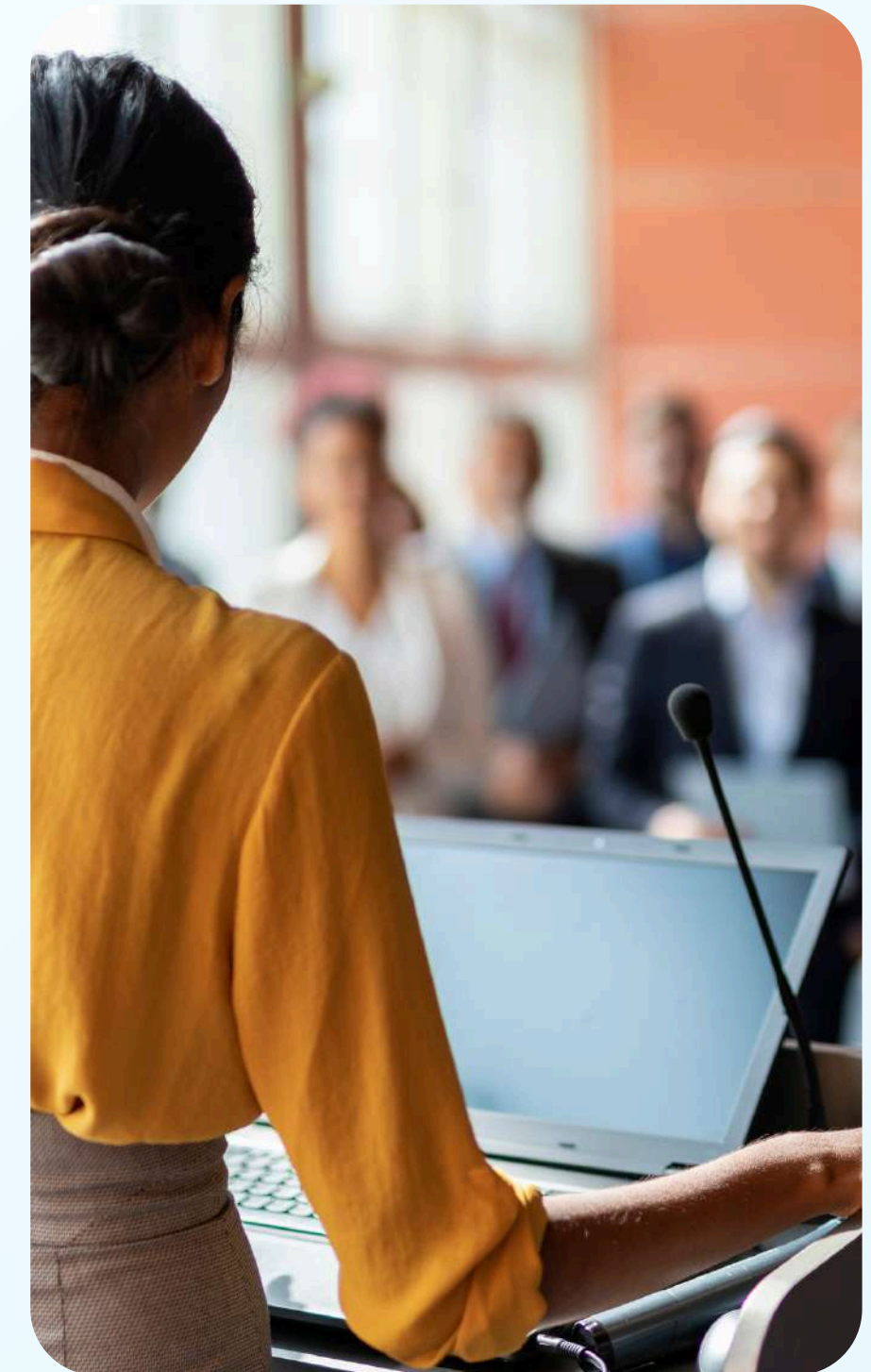
Understanding **Andragogy** in **Light Pollution**

Learning about light pollution in adult education requires a specific approach. While younger learners often approach the topic with curiosity and the desire to explore new concepts, adults bring with them already-formed experiences, professional knowledge, and personal perspectives that shape their learning process. For this reason, the EcoLume curriculum applies the principles of andragogy—the science and art of adult education—so that learning becomes meaningful, practical, and closely connected to real life.

Adults learn best when they clearly see why knowledge is important to them. Everyday encounters with artificial lighting—from public streets to the screens we use before going to sleep—make the topic of light pollution highly relatable. When learners face the consequences of excessive or misdirected lighting, such as insomnia, disrupted ecosystems, or the loss of the starry sky, learning stops being abstract and becomes a personal experience that inspires change.

Another important element of andragogy is the use of prior experience. Learners are not empty slates, but people who already have their own stories and observations about light—memories of city streets flooded with intense lighting, feelings of safety in well-lit spaces, or the discomfort of intrusive light through a bedroom window. The curriculum therefore encourages participants to share their observations, compare them with others, and connect them with theoretical knowledge.

A third dimension is self-directed and active learning. Instead of passively listening, participants have the opportunity to investigate, observe, and analyze their own environment—for example, by mapping local light pollution or reflecting on personal screen-use habits. This develops a sense of responsibility for their own learning, as well as motivation to apply knowledge in practice.

In the context of andragogy, learning about light pollution is not only a technical issue of lighting, measuring instruments, or urban planning. It is a process that connects ecology, health, technology, and society. Adult learners are guided to recognize the links between artificial light and the circadian rhythm, between lighting habits and urban policies, and between personal choices and global ecological consequences. This interdisciplinarity deepens learning and allows it to evolve beyond knowledge alone, transforming into a new way of seeing the world.

Finally, andragogy in this curriculum means empowering adults to become agents of change. Once they understand the problem and learn to recognize solutions, participants are prepared to take action—whether through small personal choices, such as using warmer light sources, or through professional and social roles, advocating for sustainable practices in their communities. In this way, learning does not stop in the classroom but continues to be lived in practice, creating a culture of responsible and mindful use of light.

Duration and teaching methods

The VET EcoLume project curriculum is structured for a total duration of 29 hours. Its pedagogical framework is meticulously designed to provide a comprehensive and practical educational experience through a blend of diverse teaching methods. This approach aims to equip learners with interdisciplinary competencies in crucial areas such as lighting design, energy efficiency, and environmental impact assessment.

The core teaching methods integrated throughout the curriculum include:
- Theoretical foundations: Providing essential background knowledge to understand light as a physical phenomenon, its evolution, forms of pollution (skyglow, glare, light trespass), and its widespread impacts on human health, biodiversity, and ecosystems. This ensures a shared understanding of core concepts.
- Guided and work-based learning: Engaging participants in practical activities, real-world examples, and problem-solving exercises. This hands-on approach involves identifying poor lighting practices, analyzing case studies, using physical and digital measurement tools, and developing diagnostic maps or lighting proposals. This segment is crucial for applying theoretical knowledge in tangible scenarios.
- Independent study: Allowing learners to deepen their understanding through self-paced research, reflection, and completion of tasks outside of guided sessions.

This blended learning methodology ensures individuals acquire not only foundational knowledge but also develop practical abilities, preparing them effectively for roles in light management and light pollution mitigation.
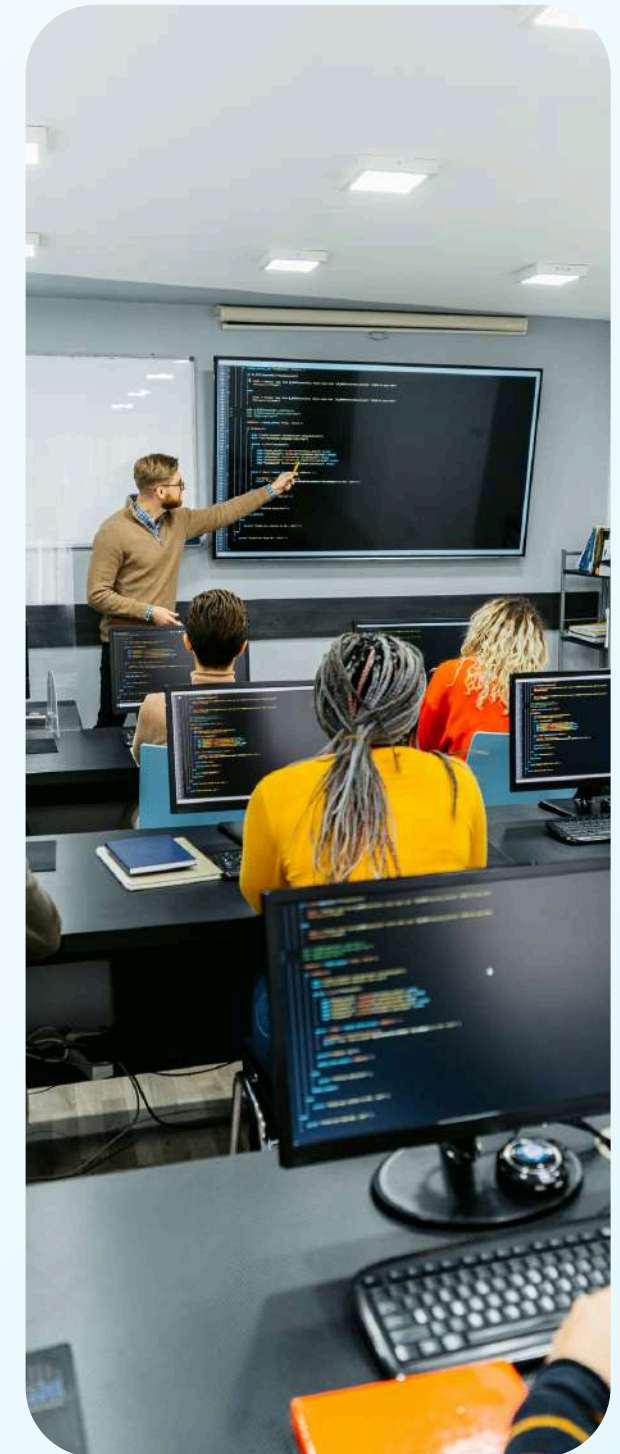
Module 1

Introduction to Light and Light Pollution

Introduction to **Light** and **Light Pollution**

This Module Introduction to Light and Light Pollution provides the foundational knowledge needed to understand light as both a physical phenomenon and a human-designed technology. Participants explore the evolution of lighting, from natural sources to modern LED systems, and learn to distinguish key technical concepts such as light spectrum, measurement units, and color temperature. The module fosters critical reflection on how artificial light shapes our perception of nighttime environments.

Building on this foundation, the module introduces the concept of light pollution, its main forms—skyglow, glare, and light trespass—and its impacts on human health, biodiversity, and ecosystems. Participants examine real-world examples and engage in practical activities to identify poor lighting practices and propose sustainable alternatives. This introductory module encourages awareness and responsibility in the use of artificial light as a first step toward more sustainable nighttime practices.

Module 1

Objectives:
- Establish a shared understanding of what light is and how artificial light is used.
- Understand how the misuse of artificial light results in various forms of light pollution.

Planned learning outcomes:
At the end of this module, participants will be able to:
1. Describe the main characteristics of natural and artificial light, including historical and technological developments in lighting.
2. Explain fundamental concepts related to light, such as light spectrum, measurement units, and correlated color temperature (CCT).
3. Identify and classify the different forms of light pollution, including skyglow, light trespass, and glare, using real or simulated examples.
4. Recognize principles of sustainable lighting and provide concrete examples of good lighting practices implemented in different cities.
5. Reflect on the impacts of light pollution on human health and the environment and explain the role of education and public awareness in addressing the issue.

Duration:
4 hours

Module 1

	Theoretical basics	Guided and work-based learning	Independent learning	TOTAL
	Aktivnost 1: Osnove svjetlosti i njezin razvoj	1 hour 30 minutes	30 minutes	2 hours
	Aktivnost 2: Svjetlosno onečišćenje: oblici, učinci i rješenja	1 hour 30 minutes	30 minutes	2 hours
				4 hours

Module 1

Literature and specific teaching aids required for the realization of the module:

1. Bogard, P. (2013). *The end of night: Searching for natural darkness in an age of artificial light*. Little, Brown and Company.
2. Falchi, F., Cinzano, P., Duriscoe, D., Kyba, C. C. M., Elvidge, C. D., Baugh, K., Portnov, B. A., Rybnikova, N. A., & Furgoni, R. (2016). The new world atlas of artificial night sky brightness. *Science Advances, 2*(6), e1600377. https://doi.org/10.1126/sciadv.1600377
3. Rich, C., & Longcore, T. (Eds.). (2006). *Ecological consequences of artificial night lighting*. Island Press.
4. Zielinska-Dabkowska, K. M., Schernhammer, E. S., Hanifin, J. P., & Brainard, G. C. (2023). Reducing nighttime light exposure in the urban environment to benefit human health and society. *Science, 380*(6650), 1130–1135. https://doi.org/10.1126/science.adg5277
5. Zissis, G. (2020). Sustainable lighting and light pollution: A critical issue for the present generation, a challenge to the future. *Sustainability, 12*(11), 4552. https://doi.org/10.3390/su12114552

Session 1 | Expectations / Fears / Contributions

DURATION:
2 hours

MATERIALS:

Activity 1.1 – Icebreaker: My Perception of Light
- Printed cards with questions or scenarios
- Whiteboard or flipchart

Activity 1.2 – A Journey Through Lighting Technologies
- Digital presentation (PowerPoint/Keynote/Google Slides) with historical and comparative images and videos (ICT)
- Projector and computer

Activity 1.3 – Understanding Light: Spectrum, Units, and Color Temperature
- Samples of LED luminaires with different CCTs (optional)
- Color temperature meter (optional)
- Presentation with graphs showing light spectra and measurement unit tables

Individual Learning Task – Session 1
- Internet access

EVALUATION METHODS:

- **Activity 1.1 – Icebreaker:** Observation of participation and the quality of ideas shared during group work

- **Activity 1.2 – Lighting Technologies:** Active participation in the mini-lecture and debate

- **Activity 1.3 – Light Concepts:** In-class comprehension questions

- **Individual Learning Task:** Informal review of the written reflection during the next session or as a take-home assignment

ACTIVITY 1.1: ICEBREAKER – MY PERCEPTION OF LIGHT

Duration: Guided Learning – 15 minutes

Task Description (step by step):
- **Introduction and Poll (5 min):** The facilitator will welcome participants and invite them to reflect on the importance of light in their daily lives. Participants will be asked what feelings or ideas the word "light" evokes in different contexts (natural, artificial, daytime, nighttime).
- **Sharing Perceptions (10 min):** Participants will be divided into small groups (3–4 people). Each group will receive a "Light Perception Card" with a stimulus or open-ended question (e.g., "Describe a moment or place where artificial light positively impacted your nighttime experience," or "Think of a space where natural light felt especially beautiful to you"). They will discuss and share one key observation with the whole group. This serves as a participatory activity on perceptions of light.

ACTIVITY 1.2: A JOURNEY THROUGH LIGHTING TECHNOLOGIES

Duration: Guided Learning – 40 minutes

Task Description (step by step):

- **Interactive Mini-Lecture (25 min):** The facilitator will deliver a lecture using visual examples and ICT tools (*flipchart using visual facilitation, .ppt, Canva board and similar tools are recommended*) to review different lighting technologies throughout history:
  - **Natural Light:** Discuss the Sun and Moon as original sources of light.
  - **Early Artificial Sources:** Explore the use of fire (torches, bonfires), oil (oil lamps), and candles, highlighting their limited environmental impact compared to later technologies.
  - **The Electric Revolution:** Cover the introduction of gas and electric (incandescent) lighting in the 19th and 20th centuries, which "dramatically increased artificial illumination."
  - **Pre-LED Technologies:** Present other technologies that dominated the global outdoor lighting market, such as "high-pressure sodium, mercury vapor, or metal halide lamps."
  - **The LED Era (SSL):** Explain the emergence of "solid-state lighting (SSL), such as LEDs," emphasizing their "exceptional energy efficiency" (up to ten times greater than earlier technologies) and how their "low cost" can lead to "over-lighting."
- **Guided Debate (15 min):** A discussion space will be opened for participants to explore how the technological evolution of lighting has changed our relationship with the nighttime environment and what the first signs of negative impact were. *The educator should invite participants to share one personal experience with negative impact of light.*

ACTIVITY 1.3: UNDERSTANDING LIGHT – SPECTRUM, UNITS, AND COLOR TEMPERATURE

🕐 **Duration**: Guided Learning – 35 minutes

📋 **Task Description (step by step):**
- **Key Concepts of Light (20 min):** The facilitator will explain essential definitions related to light:
  - **Light Spectrum:** Explain that "white LEDs tend to emit significantly more short-wavelength light (i.e., blue light) than other technologies." Discuss how this blue light can "intensify skyglow over cities" and alter "melatonin secretion and the human circadian rhythm."
  - **Light Units:** Introduce the basic units used to measure light (e.g., lumen, lux, candela).
  - **Correlated Color Temperature (CCT):** Define CCT in Kelvin, explaining the difference between "warm" light (lower values, e.g., 2700K, yellowish) and "cool" light (higher values, e.g., 5500K, blueish).

This can be delivered either as PowerPoint, Google Slides, or Canva presentation (as well as other presentation tools), or via using flipchart with visual facilitation approach (colorful, clear, clean and visually attractive) depending on the materials available.

- **Demonstration and Q&A (15 min):** If possible, a demonstration will be held using LED luminaires with different CCTs to visualize changes in color temperature and spectrum. A question-and-answer session will follow to ensure understanding of these technical concepts.

INDIVIDUAL LEARNING TASK (HOMEWORK) – CHAPTER 1: REFLECTION ON LIGHTING TECHNOLOGY

🕐 **Duration:** Independent Learning – 30 minutes

📋 **Task Description (step by step):**
- **Research and Notes (15 min):** Choose a specific lighting technology (ancient or modern, such as kerosene lamps, electric arc lamps, or OLEDs) that was mentioned or sparked interest and briefly research its key characteristics and its impact on the nighttime environment of its era.
- **Written Reflection (15 min):** Write a short paragraph (approx. 100–150 words) reflecting on how knowledge of the light spectrum and color temperature of artificial light sources can influence design decisions to mitigate light pollution in urban or natural environments.

Session 2 | Light Pollution: Forms, Impacts, and Solutions

DURATION:
2 hours

MATERIALS:

Activity 2.1 – Manifestations of Light Pollution
- Visual presentation with photographic examples of each type of light pollution
- Whiteboard

Activity 2.2 – Sustainable Lighting and Application Examples
- Presentation with images and descriptions of real-world sustainable lighting projects and their results

Activity 2.3 – The Importance of Education and Public Awareness
- flipcharts, at least 2 sets of markers, sticky notes and cards H and E
- optional: timer, whiteboard

Individual Learning Task – Session 2
- Mobile phone with camera (optional)
- Notebook for notes

EVALUATION METHODS:

- **Activity 2.1 – Light Pollution Types:** Case identification exercise and group feedback

- **Activity 2.2 – Sustainable Lighting:** Group discussion on how these principles could be applied locally

- **Activity 2.3 – Awareness and Education:** Group discussion and final reflection on the importance of individual and collective action

- **Individual Learning Task:** Submission of a brief description of the observations and improvement proposal for discussion at the start of the next session

ACTIVITY 2.1: MANIFESTATIONS OF LIGHT POLLUTION

Duration: Guided Learning – 40 minutes

Task Description (step by step):

- **Definition of Light Pollution (10 min):** The facilitator will introduce the concept of light pollution as "a form of environmental pollution" characterized by the "excessive or misdirected use of artificial light" (ALAN) that "disrupts the natural darkness of the nighttime environment."
- **Exploration of Manifestations (15 min):** The different forms of light pollution will be explained in detail using visual examples and ICT tools:
  - **Skyglow:** The "most immediate phenomenon" of brightening of the night sky above and around cities due to artificial light scattered by the atmosphere. It will be explained how "weather conditions such as clouds or snow" can amplify this effect and how it "reduces the contrast of astronomical objects, making them harder to observe."
  - **Light Trespass:** The projection of light "into areas where it is not wanted or needed," such as streetlights shining into bedrooms.
  - **Glare:** "Excessive brightness that causes visual discomfort or impaired vision," reducing visibility—especially for drivers, pedestrians, and cyclists. It will be emphasized that "LEDs can exacerbate glare."
- **Case Identification (15 min):** Divide the participants in pairs and explain that they have the task to review a series of images (e.g., photos of cities at night, illuminated streets) and must identify and classify the types of light pollution present in each one. After they are done, invite each pair to share their images and answers with the rest of the group. Let them know if they made correct choices, and explain if the answers for any of the photos weren't correct. Also, in the case of incorrect answers ask participants why they thought the image represents the pollution they answered and remind them of the three forms of light pollution.

ACTIVITY 2.2: SUSTAINABLE LIGHTING AND APPLICATION EXAMPLES

Duration: Guided Learning – 25 minutes

Task Description (step by step):
- **Principles of Sustainable Lighting (10 min):** The facilitator will present the key principles for "sustainable lighting":
  - **Utility:** Only illuminate what is necessary.
  - **Direction:** Direct the light downward ("full cut-off").
  - **Control:** Use of sensors and dimmers.
  - **Intensity:** Minimize excessive lighting.
  - **Color:** Prioritize warm-colored light.
- **Learn-by-doing (15 minutes)**:

Participants will receive **three short case studies**, each describing one of the following real-world examples with only the essential information provided:
- **Augsburg, Germany:** Reduction of "skyglow by 35%" through warm and motion-sensitive LEDs.
- **Freiburg, Germany:** Implementation of "light reduction zones," resulting in a "40% decrease in unnecessary lighting."
- **Jelsa and Lastovo, Croatia:** Recognized as "International Dark Sky Communities" for implementing "fully shielded lights with low color temperature" and controlling stray light.

Participants will be divided into **three small groups** (one case study per group). Their task is to **research briefly and discuss** their assigned example, answering the following guiding questions:

- *What benefits were achieved?*
- *What are the impacts of this approach?*
- *What can we learn from this case?*

Each group will **present their conclusions** in a short summary (2–3 minutes per team).

The facilitator will **wrap up** the exercise by emphasizing that, with careful planning, **LED modernization can "maintain or even reduce light pollution."**

ACTIVITY 2.3: THE IMPORTANCE OF EDUCATION AND PUBLIC AWARENESS

Duration: Guided Learning – 25 minutes

Task Description:
Before starting make sure you have set two (or more) tables with 1 flipchart, a set of markers, sticky notes and cards on each. The cards can be hand-written using colorful papers or printed out.

- **Quick warm-up (2 minutes)** Ask the participants "Where do you most encounter artificial light at night?" Invite them to share 1 example with a neighbor (30 seconds), then invite 2–3 quick shares with the whole group in order to activate prior knowledge and set context.
- **Group investigation (8 minutes)** Split the participants into two groups. (In case of larger total number of participants there can be 4 groups where A and B repeat): **Group A: Human Health (Card H)** and **Group B: Environment & Biodiversity (Card E)**. Group A should receive the following cards: circadian system disruption, melatonin suppression, blue light altering melatonin secretion and circadian rhythm, risks (sleep disorders, obesity, mental health issues, certain cancers), including short definition. Group B will receive cards that mention: ALAN as a threat to global biodiversity; affected taxa (birds—esp. migratory/navigation interference, fish, mammals, reptiles, amphibians, insects—pollinators, plants); harm to nocturnal pollinators and possible crop yield impacts; include short definitions / descriptions.

Explain that both groups have the task to read their cards and **map a simple cause-effect chain on their flip chart: Source of ALAN → Mechanism → Key impacts → A local or familiar example.** They should create the maps using the cards provided and write their answers on sticky notes. Once they create these maps for each of the cards they should write down a one-sentence takeaway for each of them that anyone could understand (keep the language simple and short).

- **Mini-clarification by facilitator** (2 minutes) The exercise will be followed by providing a crisp recap to ensure shared baseline: "Blue light at night can alter melatonin secretion and the human circadian rhythm, increasing risks such as sleep disorders, obesity, mental health issues, and some cancers."; "ALAN threatens global biodiversity, affecting nearly all studied species; it interferes with bird navigation and harms nocturnal pollinators, which can ripple into reduced crop yields."

- **Peer teaching: Teach-back across groups (6 minutes)** Following the previous task each group will have 2 minutes to explain their cause-effect chain and takeaway to other groups. Other participants will have 1 minute to ask questions in case they'll need further clarifications. The facilitator should encourage plain-language explanations and one concrete example.

- **Co-design awareness actions (5 minutes)** In this step form mixed pairs (one person from Group A + one from Group B). Explain participants that they have the task to design a 30-second awareness or education action that could work in their community or school; out of the following examples: **school lesson snippet, social media post idea, neighborhood poster, simple policy suggestion for a local facility (e.g., motion sensors, warmer/amber lights, shielded fixtures, curfews).** (Write down the examples prior on a flipchart or show them on a whiteboard) Their awareness raising or education action must include: **why ALAN matters (health or biodiversity), one actionable behavior, and who should do it.** Follow by providing space to each pair to share a one-sentence pitch. **Optional quick vote: Which awareness idea is most feasible for us?**

- **Debrief and next step (2 minutes)** Start the debriefing by asking: "What's one thing you'll start or stop doing about nighttime lighting?" Wrap up by "discussing the role of education and public policy." Facilitator should highlight that "public awareness and education are crucial" to addressing the issue, as "long-term success depends on an informed society." The need to "include education about light pollution in schools and community programs" should be emphasized.

INDIVIDUAL LEARNING TASK (HOMEWORK) – CHAPTER 2: RECOGNIZING LIGHT POLLUTION IN MY ENVIRONMENT

Duration: Independent Learning – 30 minutes

Task Description (step by step):

1. **Critical Observation (15 min):** Conduct a mindful observation of the nighttime lighting environment at home or in the neighborhood. Identify at least one example of each type of light pollution (skyglow, light trespass, glare). If possible, take a photo of each example.

2. **Improvement Proposal (15 min):** For one of the identified examples, propose a concrete solution based on the sustainable lighting principles learned. Explain how this solution would mitigate the negative impact and what its benefits would be (e.g., for health, the environment, energy savings).
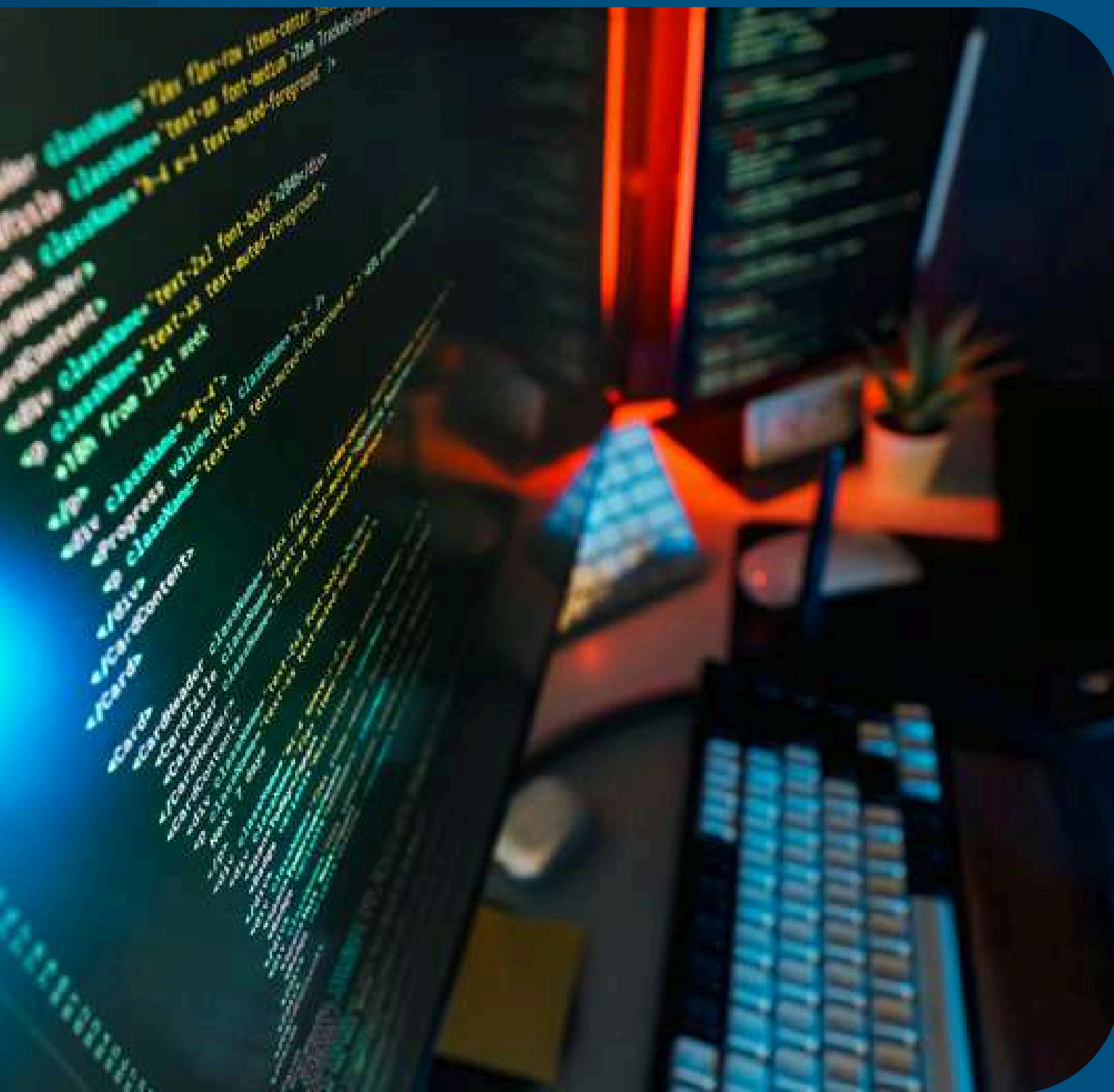
Module 2

Diagnosis and Monitoring of Light Pollution: Key Concepts and Tools

Diagnosis and Monitoring of Light Pollution:
Key Concepts and Tools

This module provides participants with the knowledge and skills to understand, measure, and characterize light pollution in different contexts. It starts with an introduction to the concept, history, and key dimensions of light pollution, highlighting its effects on human health, ecosystems, and urban development. Participants then explore physical and digital tools for diagnosis, such as Sky Quality Meters, mobile applications, and satellite data sources (e.g., VIIRS and Light Pollution Map), learning both their potential and limitations. Through guided group activities, learners analyze case studies, compare measurements, and critically assess local and global patterns of nighttime radiance.

The module also emphasizes practical application: participants practice luminaire characterization, identify different types of light pollution (skyglow, glare, and light trespass), and develop participatory diagnostic maps that combine technical data with community-based observations. By the end, participants are able to link theoretical understanding with real-world monitoring practices, providing a solid basis for evidence-based solutions and sustainable lighting strategies.

Module 2

Objectives:
- Introduce the concept of light pollution, including its definition, history, and impacts.
- Explore the key concepts of light and sustainable lighting.
- Analyze the different dimensions of the problem, including its effects on health, the environment, and the economy.
- Reflect on the importance of public awareness and the role of education in mitigation.

Planned learning outcomes:
By the end of this module, participants will be able to:

1. Explain the concept, history, and main impacts of light pollution, linking them to health, environmental, and urban dimensions.
2. Describe the fundamental properties of light (spectrum, units, color temperature) and their relevance for sustainable lighting.
3. Use physical and digital tools (e.g., SQM, mobile apps, satellite data) to diagnose and monitor light pollution.
4. Characterize luminaires and develop participatory diagnostic maps to identify problems and propose mitigation strategies.

Duration:
6 hours 30 minutes

Module 2

Theoretical basics	Guided and work-based learning [min]	Independent learning [min]	TOTAL [min]
Session 1: Fundamentals of Light and Light Pollution	60	30	90
Session 2: Digital and Physical Tools for Measurement	40	80	120
Session 3: Characterization and Mapping of Light Pollution	90	90	180
			390 minutes

Module 2

📚 Literature and specific teaching aids required for the realization of the module:

1. AYUNTAMIENTO DE MURCIA (S.F), El lado oscuro de la luz. Contaminación lumínica, [Catalogo], Murcia, España, Museo de la Ciencia y el Agua, Recuperado de https://cienciayagua.org/wp-content/uploads/2016/04/el_lado_oscuro_de_la_luz.pdf
2. Light pollution map. (s. f.). https://www.lightpollutionmap.info/
3. VIIRS Nighttime Lights Monthly Cloud-Free Composite. (s. f.). ArcGIS Online. Recuperado 18 de junio de 2025, de https://www.arcgis.com/home/item.html?id=edabcbb5407547f5bc883018eb6e7986
4. Jägerbrand, A., Gasparovsky, D., Bouroussis, C., Schlangen, L., Lau, S., & Donners, M. (2022). Correspondence: Obtrusive light, light pollution and sky glow: Areas for research, development and standardisation. Lighting Research & Technology, 54(2), 191–194. https://doi.org/10.1177/14771535211040973
5. Leibniz Institute for Freshwater Ecology and Inland Fisheries. (2023). Dark skies for future: Citizen science and light pollution awareness initiatives in Germany. https://www.igb-berlin.de
6. Mayer-Pinto, M., Jones, T. M., Swearer, S. E., Robert, K. A., Bolton, D., Aulsebrook, A. E., et al. (2022). Light pollution: a landscape-scale issue requiring cross-realm consideration. UCL Open Environment, 4. https://doi.org/10.14324/111.444/ucloe.000036
7. NOIRLab. (2024). Light pollution measurements of Chilean night sky. https://noirlab.edu/science/news/announcements/sci24029
8. Yakushina, Y., Smith, D., & Sanchez De Miguel, A. (n.d.). Light Pollution: Challenges and Responses for Monitoring. https://darksky.org/app/uploads/2025/02/EU-Manifesto-1.pdf
9. Zielinska-Dabkowska, K. M., Schernhammer, E. S., Hanifin, J. P., & Brainard, G. C. (2023). Reducing nighttime light exposure in the urban environment to benefit human health and society. Science, 380(6650), 1130–1135. https://doi.org/10.1126/science.adg5277
10. Zissis, G. (2020). Sustainable lighting and light pollution: A critical issue for the present generation, a challenge to the future. Sustainability, 12(11), 4552. https://doi.org/10.3390/su12114552

Session 1 | Fundamentals of Light and Light Pollution

DURATION:
90 minutes

MATERIALS:
- Sticky notes, markers, flip charts.
- Internet access (phones/laptops for group research).
- Projector and presentation slides.
- Case study handouts on impacts (prepared by the facilitator).

EVALUATION METHODS:
- Activity "What is Light for You?" – Observation of participation and the diversity of associations shared, facilitator notes engagement and reflection quality during the exercise.
- Group Research on Impacts – Assessment of group collaboration and accuracy of key points presented for each area (health, environment, economy). Criteria: clarity, factual grounding, and connection to real-world examples.

ACTIVITY – "WHAT IS LIGHT FOR YOU?" (10 MINUTES)

Welcome the participants. Explain that the session begins by exploring personal meanings of light.

Distribution of materials. Hand out three post-its and a marker to each participant.

Trigger question. Indicate: *"Write on each post-it one word or short phrase that you associate with light or night."*

Posting and grouping. Participants place their notes on the board or wall. While they do so, group concepts under visible labels such as: Safety, Health, Science, Environment, Emotions, Culture, Technology, Art (add or remove categories as needed based on participants' input).

Guided group reflection. Invite the group to discuss:
- Which categories have the most contributions?
- Are there ideas that are surprising or that do not fit?
- Does any category raise concern when we think about artificial light?

Briefly note the key conclusions.

Transition. Connect to the next activity: *"Now that we have seen our own associations, let's analyze what science says about light and its less visible side: light pollution."*

INTRODUCTION TO THE CONCEPT OF LIGHT POLLUTION (25 MINUTES)

The facilitator gives a slide presentation supported by ICT covering:

- Definition and scope of light pollution: Emphasize that, by definition, all artificial lighting is polluting.
- Overview of the historical context and the growth of the problem.
- Global perspective of the issue.
- Key concepts of light: radiance, spectrum, units, color temperature.
- Sustainable lighting: definition and examples.
- Participants are encouraged to ask questions and add examples from their own knowledge or experiences.

*The presentation can be found in the module's instruction manual.*

EXPLORING IMPACTS: HEALTH, ENVIRONMENT, AND ECONOMY (30 MINUTES)

Divide the participants into small groups with 3–4 people in each and assign one of the following areas of impact to each group to investigate and present:

- **Impact on Human Health:**
  - This group has the task to review: Quantifiable and non-quantifiable risks of light pollution. Effects on circadian rhythm and chronic diseases. General impacts on human health.
  - Provide participants with an example source: The *EnlightenMe* project in Tartu, Estonia, investigated the effects of indoor and outdoor lighting on population health.
- **Environmental and Ecological Impact:**
  - This group has the task to review: Effects on fauna (birds, insects, turtles, etc.), flora, and urban ecosystems. Disruption of nocturnal wildlife.
  - Provide participants with an example source: The *Leibniz Institute of Freshwater Ecology and Inland Fisheries (IGB)* in Germany emphasized the importance of limiting short-wavelength blue light emissions, which severely disrupt nocturnal ecosystems, recommending a transition to amber or warm-white LEDs.
- **Economic and Urban Impact:**
  - This group has the task to review: Unnecessary energy consumption and increased carbon footprint. Issues in urban planning and development.
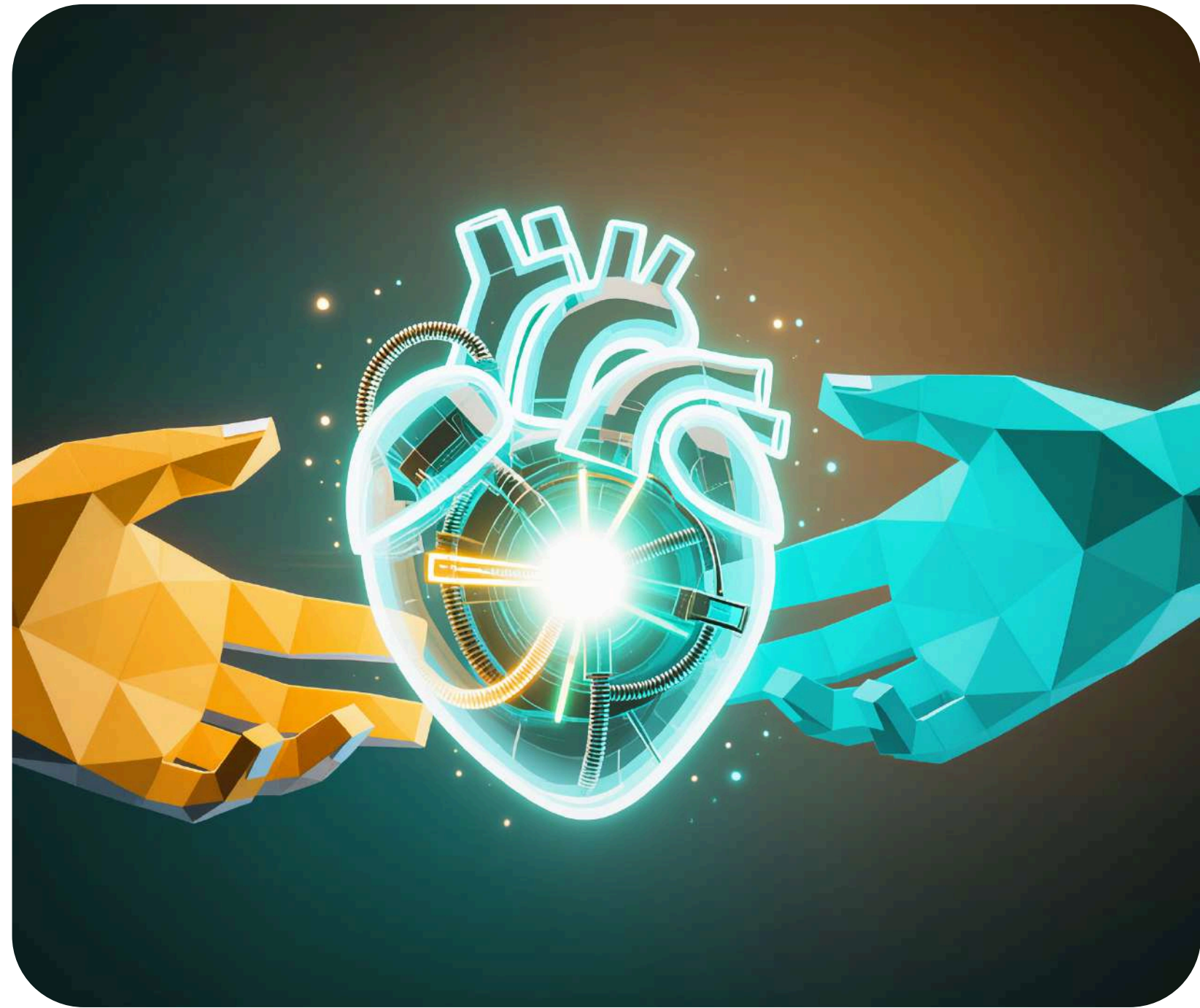
○ Provide participants with an example source: In Colombia, a study used VIIRS satellite images to correlate GDP growth with the increase in artificial light emissions, although some cities managed to stabilize or even reduce average radiance levels by applying good urban planning and technological practices. In Croatia, the development of transportation infrastructure and suburbanization contributed to increased light pollution.

Each group has to prepare a brief visual summary and present their key findings to the rest of the participants. Allow 20 minutes for inquiry and 3–5 minutes per group for presentations. Wrap up by summarizing key takeaways from each group.

DISCUSSION ON AWARENESS AND EDUCATION (20 MINUTES)

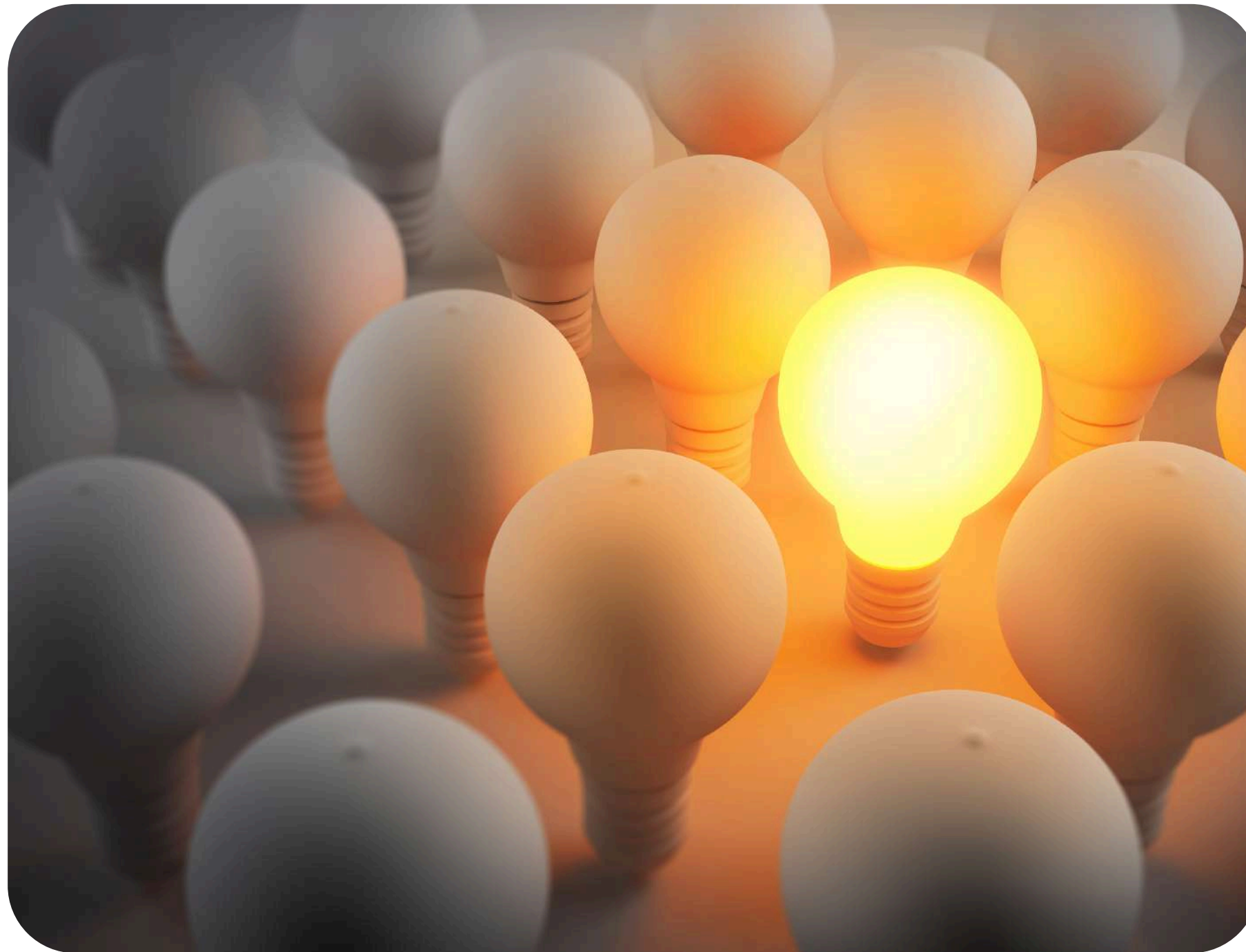**In plenary, participants reflect on the following questions:**

- What is the level of public awareness about light pollution? Despite growing evidence of its harmful effects, public awareness remains limited. Surveys in Germany and Colombia reveal widespread familiarity, but significant gaps in in-depth knowledge of the impacts.
- What role can educational programs and vocational training play in mitigating light pollution?
- The discussion should include how to strengthen regulations, promote sustainable lighting practices, and implement cross-sectoral management strategies. The educator should emphasize that education and Technical and Vocational Education and Training (TVET) play a fundamental role in long-term mitigation, by creating professionals with interdisciplinary competences.

The facilitator moderates the discussion and encourages concrete ideas for integrating this topic into existing training frameworks.

PLENARY REFLECTION AND SESSION CONCLUSION (5 MINUTES)

The facilitator invites participants to reflect on the session, using the following structure:

- One idea I gained about light pollution...
- One way I can use this session with my students...
- One thing I want to explore further...

DURATION:
120 minutes

MATERIALS:
- Sky Quality Meter (SQM) (if available).
- Smartphones with access to light measurement applications.
- Computers/laptops with internet access for LightPollutionMap.info and VIIRS data.
- Projector and slides.
- Various materials for group division energizes.

EVALUATION METHODS:

- **Estimating Sky Quality with Simple Observation Methods:**

Evaluation will focus on participants' engagement and the accuracy of their qualitative observations. The facilitator will assess the completeness of the observation sheets and the reasoning used to justify the assigned ratings (1–5). Reflection on how non-specialized methods can support citizen science will also be considered.

- **Satellite Map Analysis:**

Evaluation will be based on the group's ability to correctly interpret and compare light pollution data from online tools (e.g., LightPollutionMap, VIIRS). Criteria include teamwork, clarity of the visual summary, and capacity to identify patterns and limitations in satellite data.

- **"My Night Environment":**

Assessment will emphasize the relevance of observations, creativity in documenting the nighttime environment, and the quality of proposed insights or local connections. Participation in the group discussion will also contribute to evaluation.

👥 ACTIVITY – "HOW DO WE MEASURE IT?" (10 MINUTES)

In plenary, the facilitator asks participants to name objects or phenomena that can be measured and then discusses how "light" or "sky quality" might be measured. The facilitator writes down the ideas on flipchart or whiteboard (physical or online). This brainstorming exercise introduces the idea of measurement tools.

ESTIMATING SKY QUALITY WITH SIMPLE OBSERVATION METHODS (30 MINUTES)

This activity helps participants explore how the quality of the night sky can be estimated without specialized instruments, using simple observational and comparative methods that are accessible to everyone.

- **Introduction (5 min):**

The facilitator explains that even without a Sky Quality Meter (SQM), it is possible to estimate the brightness of the night sky by observing visible stars, artificial light sources, and environmental conditions. The facilitator introduces the idea of qualitative observation as a first diagnostic step.

- **Observation Criteria (10 min):**

The group reviews simplified indicators for assessing sky quality, adapted from citizen science projects such as Globe at Night and Loss of the Night. Each participant receives a short reference sheet with three key indicators:
    - Visibility of stars: How many stars can you see in a known constellation (e.g., Orion or Ursa Major)?
    - Presence of artificial light: Are there visible light domes, glare from buildings, or illuminated clouds?
    - Local lighting environment: What types of luminaires or lights are nearby (e.g., LED, streetlights, signs)?

- **Simulated Night Assessment (10 min):**

Since the session occurs indoors, the facilitator shows a series of photographs (or slides) representing different night skies—from pristine dark-sky areas to urban centers.

Participants work in pairs to rate each image on a 1–5 scale (1 = very dark sky, 5 = heavily light-polluted) and record brief notes about visible features influencing their rating.

- **Group Discussion (5 min):**

After completing their observations, participants discuss patterns:
  - What visual cues made some skies appear darker or brighter?
  - How might weather, terrain, or light direction affect visibility?
  - How could these simple methods help engage communities in monitoring light pollution?

The facilitator concludes by emphasizing that qualitative observation and citizen science tools can complement more advanced instruments and serve as a valuable first step in light pollution assessment.

👥 SATELLITE MAP ANALYSIS (40 MINUTES)

Participants are divided into small groups (*in case the total number of participants is large the groups can be repeated*).

Use group dividing exercises / energizers in order to split participants in small groups such as the following options:

1. *Create a box with small papers with a fruit written on them. Explain to participants that you will call out one fruit and everyone with that paper should get up and change seat. Repeat several times. In the end tell participants to form small groups with other participants that have the same fruit written on their paper. (Instead of fruit you can write down colors, animals, objects etc.)*

2. *Create a box with different types of candies or small chocolates. Prepare the candies according to the number of participants you want to have in each group. Share the candies to participants instructing them to only take one. Once they do tell them to form small group with people that have the same type of candy / chocolate.*

3. *Mark four corners in the room with colorful papers, markers, numbers or different objects. Tell participants to gather in the middle of the training space and then announce: "Pick any corner, maximum 5 people (can be less or more, according to your needs) in one!" On "Go," participants should jog to a corner. If the corner fills with expected number of participants, late arrivals move to another. Repeat 2-3 times and on the final one explain participants that the people in one corner should form one small group.*

4. *Gather participants in a large circle. Everyone should choose a "Rock, Paper, Scissors" sign and show it on 3...2...1. Tell them to held their hands high so they can see what everybody else chose. Once they all show rock, paper or scissors the participants quickly form groups with others who chose the same sign. (In case you need more small groups add more elements to the rock, paper, scissors game or form multiple groups of each element). You should repeat the game until you have desired number of participants in each small group.*

5. *Gather participants in a large circle. Familiarize with their clothes / shoes / birthdays or other specifics. Explain that when you call out certain specific they should create a group with people sharing that specific (for example: participants wearing jeans form one group, or participants wearing black form one group). Make sure to call out those specifics that enable you to form groups with desired / needed number of participants.*

These options can be used throughout the program as needed.

Once the groups are formed they receive the task to explore satellite maps:
- **Group 1:** Explore *LightPollutionMap.info*. Identify global and regional patterns of light pollution (www.LightPollutionMap.info).
- **Group 2:** Analyze VIIRS data (Visible Infrared Imaging Radiometer Suite: https://www.arcgis.com/home/item.html?id=edabcbb5407547f5bc883018eb6e7986). Calculate the percentage of emissions from a municipality relative to its area (Reflective area / Total municipal area * 100).

Content to review: Explanation of the use of VIIRS satellite images to analyze nighttime radiance.

Example: In Colombia, a study led by the National University established a correlation between GDP growth and increased artificial light emissions. However, cities such as Medellín, Bucaramanga, and Cali managed to stabilize or even reduce average radiance levels.
Limitations: The Colombian study also highlighted technical limitations in the satellite's ability to detect horizontally emitted light, typical of LED luminaires, which may underestimate the real impact on the night sky. Each group prepares a visual summary of their findings and the limitations of the tools explored. Allow 30 minutes for exploration and 15 minutes for presentations and discussion.

PRACTICAL EXERCISE: "MY NIGHT ENVIRONMENT" (35 MINUTES)

- For this exercise, participants need to bring photos or images of their homes or workplaces at night. The facilitator should instruct students beforehand to bring this material to class.
- If possible, participants use their smartphones to take photos or use light measurement apps in their current environment (or in a simulated setting).
- They share their results and discuss what type of information these tools provide and how it compares to satellite map data.

👥 PLENARY REFLECTION AND SESSION CONCLUSION (5 MINUTES)

The facilitator leads a closing discussion with questions such as:
- What was the most revealing tool you discovered today?
- What challenges do you foresee in using these tools in practice?
- How can you integrate the use of these tools into your students' education?

Session Outcomes:
- Participants are familiar with both digital and physical tools for measuring light pollution.
- They can use SQM, mobile applications, and analyze satellite maps such as VIIRS.
- They understand the limitations and considerations involved in using these tools for diagnosis.

DURATION:
180 minutes

MATERIALS:
- Characterization sheets (printed or digital).
- Computers/laptops with access to Google Maps.
- Cameras or smartphones for documentation.
- Flip charts, markers, sticky notes.

EVALUATION METHODS:

- **"Light Detectives":**

Evaluation will focus on participants' ability to correctly identify and distinguish between environmentally responsible and problematic lighting types. The facilitator will observe the reasoning provided for each judgment and the application of key concepts such as direction, color temperature, and light intensity.

- **Characterization of Luminaires and Types of Impact:**

Assessment will be based on the accuracy and completeness of the characterization sheets, as well as the clarity of group presentations. Criteria include correct identification of luminaire properties (emission angle, optics, CCT, energy efficiency) and the connection made between these properties and observed impacts (skyglow, light trespass, glare).

- **Participatory Mapping and Diagnostic Map Creation:**

Evaluation will emphasize teamwork, analytical thinking, and creativity in mapping exercises. The facilitator will assess whether participants successfully applied the five principles of responsible lighting (utility, direction, control, intensity, color) and provided feasible proposals for improvement in their mapped areas.

👥 ACTIVITY – "LIGHT DETECTIVES" (20 MINUTES)

The facilitator shows images of different types of luminaires or outdoor lighting scenes. After that the participants are divided into pairs with the task to identify whether the lighting appears "good" or "bad" for the environment, justifying their answers in order to foster observation and critical analysis of lighting. The facilitator can also ask participants beforehand to bring photos of luminaires they find near their homes and workplaces.

👥 INPUT: CHARACTERIZATION OF LUMINAIRES AND TYPES OF IMPACT (40 MINUTES)

The facilitator introduces the key elements for lighting characterization:
- Types and characteristics of luminaires: emission angle, optics, color temperature, power, energy efficiency.
- Types of outdoor lighting and spectra.
- Importance of integral design: Emphasis is placed on the fact that new professionals in sustainable lighting must have concepts of integral design, selecting luminaires that are both energy-efficient and beneficial for human health and environmental protection.
- Impacts of light pollution: skyglow, light trespass, glare.

👥 PRACTICE WITH CHARACTERIZATION SHEETS (40 MINUTES)

Participants work groups of 3 or 4 (*use group division exercise provided before*) to complete characterization sheets for different lighting scenarios (simulated or real, based on provided photos/videos).

Provide each group with a flipchart and set of markers (optionally: use laptops and create small presentation with a tool of their choice) and tell them that in the following 20 minutes they should analyze:

- Type of luminaire and its direction (full cut-off, semi-cut-off, etc.).
- Color temperature (warm LEDs, cool LEDs).
- Possible observed impacts (skyglow, light trespass, glare).
- Energy efficiency and whether they comply with responsible lighting principles.

Once they finish the task, provide space for all groups to share their findings in up to 5 minutes presentations. Other participants can ask questions / clarifications.

Once all groups present their findings wrap up by discussing the differences in characterization.

👥 PARTICIPATORY MAPPING AND CREATION OF A DIAGNOSTIC MAP (50 MINUTES)

Step 1: Start by dividing participants into two groups with a maximum of 6 people in each using energizers provided before. 5 minutes (In case of a larger total number repeat group 1 and 2).

Step 2: Once the small groups are formed explain that each of them will have different task:

1. **Group 1:** Using Google Maps, participants should select a familiar area (their city, neighborhood) and mark points where they observe different types of light pollution impacts (skyglow, light trespass, glare).
2. **Group 2:** Participants are asked to create an "urban redesign" of a space (park, street, commercial area) applying the five principles of responsible lighting: utility, direction, control, intensity, and color. They may use photographic documentation from their own environment.

Both groups should create an interactive "diagnostic map" in Google Maps or a digital/physical poster, marking problematic points and/or proposed solutions.

Allow 30 minutes for the task.

Step 3: Each group presents their results to the rest. 15 minutes

REFLECTION AND SESSION CONCLUSION (30 MINUTES)

The facilitator guides a final discussion:

- What challenges arose in characterizing lighting and mapping impacts?
- How can this knowledge be applied in practice for mitigation?
- What is the importance of photographic documentation and mapping in the work of a light pollution mitigation specialist?
- How can you use the knowledge gained in your daily personal and / or professional life?

Module 3

Environmental and Health Impact Assessment of Light Pollution

Environmental and Health Impact Assessment of Light Pollution

This module explores how different natural and urban environments vary in their sensitivity to artificial light and examines the wide-ranging impacts of light pollution on ecosystems, human health, and nighttime experiences. Through hands-on activities and guided reflections, participants classify environments by sensitivity, assess the consequences of artificial lighting, and connect local observations with global challenges.

Key topics include the classification of environmental sensitivity, the use of tools like the Leopold Matrix, the influence of screen use on health and sleep, and the biological importance of circadian rhythms. The module fosters critical thinking and awareness of how lighting practices intersect with ecological integrity and personal well-being, encouraging learners to identify practical solutions for their own communities.

Module 3

Objectives:
- Understand how different environments respond to artificial light exposure and develop the ability to classify them based on their ecological and functional sensitivity to light pollution.
- Analyze the physiological, psychological, and ecological effects of artificial light at night (ALAN), promoting informed reflection on its impacts on human health, biodiversity, and urban life.

Planned learning outcomes:
By the end of this module, participants will be able to:
1. Classify different natural and urban environments according to their sensitivity to artificial light and explain the rationale behind these classifications.
2. Identify and describe the environmental, health-related, and social consequences of light pollution using real or simulated scenarios.
3. Use tools such as the Leopold Matrix to analyze the presence and impact of artificial lighting in specific locations.
4. Reflect on the relationship between screen use, circadian rhythms, and personal health, and propose healthier strategies for light exposure in daily life.
5. Recognize the importance of ecological and human-centered approaches when designing nighttime lighting practices in diverse contexts.

Duration:
6 hours

Module 3

Theoretical basics	Guided and work-based learning [min]	Independent learning [min]	TOTAL [min]
Session 1: Classification of Environmental Sensitivity	70	15	85
Session 2: Light Pollution Walk	60	30	80
Session 3: My Life on Screen: Healthy Strategies	90	0	90
Session 4: Circadian Cycles	105	0	105
			360

Module 3

📚 **Literature and specific teaching aids required for the realization of the module:**

1. Rajput, S., Naithani, M., Meena, K., & Rana, S. (2021). Light pollution: Hidden perils in light and links to cancer. Sleep and Vigilance, 5(1), 5–16. https://doi.org/10.1007/s41782-020-00123-3
2. Rats, L. (2023, December 24). Festive light pollution can impact sleep patterns of humans and birds. ERR; Eesti Rahvusringhääling | ERR. https://news.err.ee/1609204090/festive-light-pollution-can-impact-sleep-patterns-of-humans-and-birds
3. Münch, M., & Bromundt, V. (2012). Light and chronobiology: implications for health and disease. Dialogues in Clinical Neuroscience, 14(4), 448–453. https://doi.org/10.31887/DCNS.2012.14.4/mmuench
4. Boyce P. Light, lighting and human health. Lighting Research & Technology. 2021;54(2):101-144. doi:10.1177/14771535211010267
5. Boyce PR. Review: The Impact of Light in Buildings on Human Health. Indoor and Built Environment. 2010;19(1):8-20. doi:10.1177/1420326X09358028
6. Pauley, S. M. (2004). Lighting for the human circadian clock: Recent research indicates that lighting has become a public health issue. *Medical Hypotheses*, 63(4), 588–596. https://doi.org/10.1016/j.mehy.2004.03.020
7. Falcón J, Torriglia A, Attia D, Viénot F, Gronfier C, Behar-Cohen F, Martinsons C and Hicks D (2020) Exposure to Artificial Light at Night and the Consequences for Flora, Fauna, and Ecosystems. Front. Neurosci. 14:602796. doi: 10.3389/fnins.2020.602796
8. Jägerbrand, A.K.; Bouroussis, C.A. Ecological Impact of Artificial Light at Night: Effective Strategies and Measures to Deal with Protected Species and Habitats. Sustainability 2021, 13, 5991. https://doi.org/10.3390/su13115991
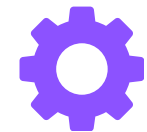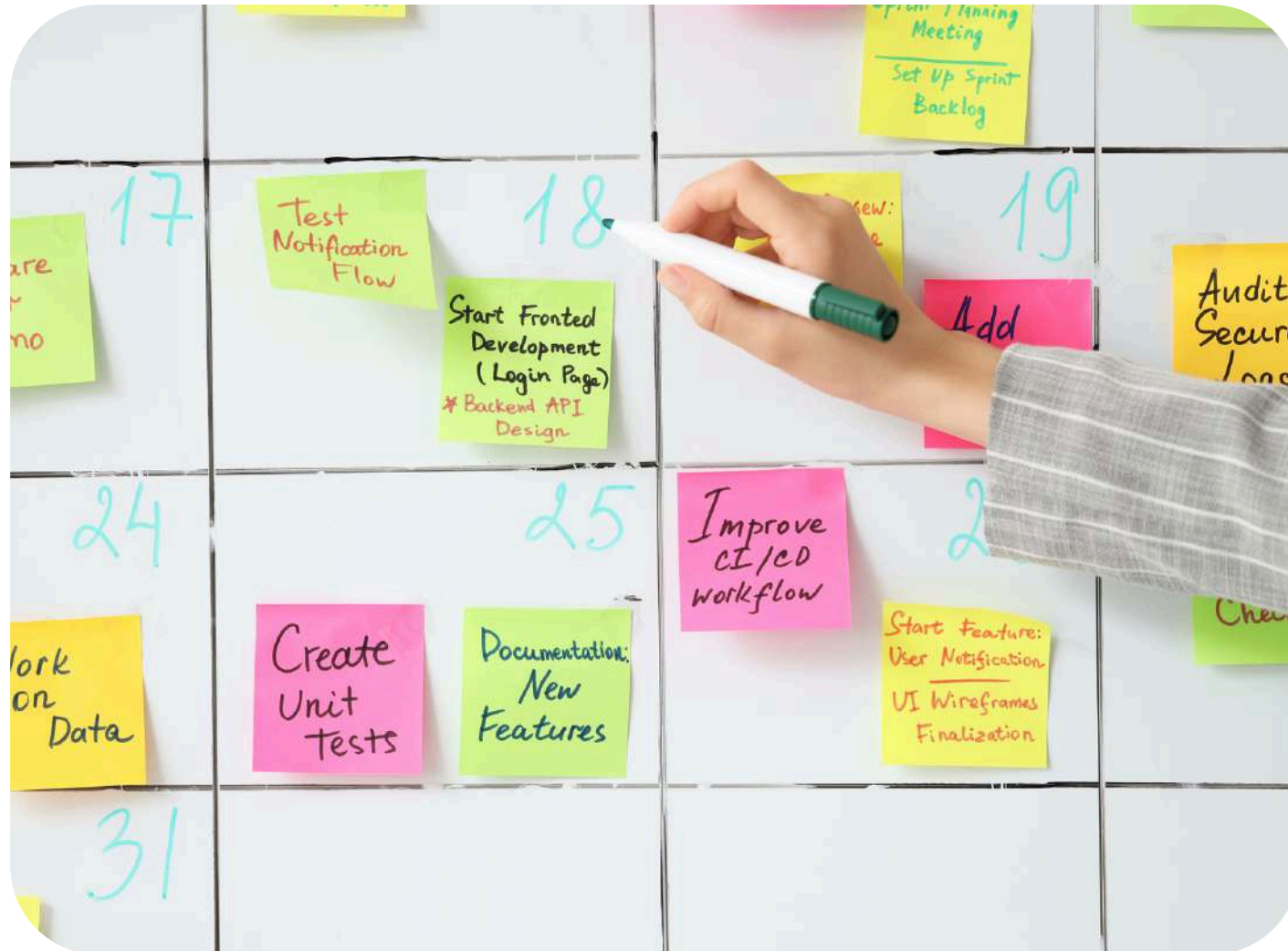
Session 1 | Classification of Environmental Sensitivity

DURATION:
85 minutes

MATERIALS:
- Set of cards
- Masking tape
- Board / Whiteboard
- Dry-erase markers
- Sticky notes

EVALUATION METHODS:

- **Identifying Sensitive Environments:**

Evaluation will focus on participants' ability to correctly recognize and categorize different environments (urban, rural, natural, astronomical, residential, agricultural) according to their sensitivity to artificial light. The facilitator will observe reasoning during group discussions and the use of appropriate environmental and ecological criteria.

- **Application of the Leopold Matrix:**

Assessment will be based on the accuracy and coherence of the matrices developed by each group to link light sources with potential environmental and social impacts. Criteria include clarity of cause–effect relationships, justification of impact ratings, and teamwork during the exercise.

- **Group Presentations:**

Evaluation will emphasize the quality and conciseness of group presentations summarizing their classification outcomes. Participants should demonstrate understanding of how environmental sensitivity guides lighting policies and mitigation strategies.

👥 ACTIVITY – "WHAT DOES LIGHT POLLUTION AFFECT?" (35 MINUTES)

Step 1. Welcome. The educator explains that the session will begin by exploring the levels of light sensitivity of different elements in nature. The participants should be divided into a minimum of 2 groups, with a maximum of 5 people in each. In case there is a larger group of participants small groups can be repeated. The educator can use proposed energizers from Module 2, or any others.

Step 2. Distribution of Materials. Each group will receive a set of cards (materials provided by the organization), each representing a different environmental element (for example, nocturnal wildlife habitat, astronomical observatory, residential area, agricultural land, among others). Prepare these cards beforehand, either printed or in digital version.

Step 3. Trigger Question. Start by saying: "We are going to classify the cards in order of sensitivity to light pollution, from most sensitive to least sensitive. You must justify your classification based on your understanding of the possible impacts of light pollution on each element."

Step 4. Classification. Groups carry out their classification over a period of 20 minutes. *They can paste the cards on a flipchart in order to make a map from most to least sensitive, or receive the cards in digital format and create a map using Canva board or similar online tool.*

Step 5. Group Reflection. The educator will wrap up with a discussion of approximately 10 minutes, comparing the classifications and highlighting the different perspectives and considerations involved in assessing environmental sensitivity

👥 IMPACT NETWORK – HOW FAR DO THE IMPACTS REACH? (60 MINUTES)

Step 1. Activity Start. Keep the participants divided into small groups of up to 5 people. Assign each group a specific category of light pollution impact (for example: effects on nocturnal animals, human health, energy waste, astronomical research). Each group researches its assigned topic. (15 minutes)

Step 2. Identify Consequences. Each participant writes on a sticky note one consequence of light pollution in the assigned category (it may be environmental, health-related, economic, etc.). (15 minutes)

Step 3. Group Sharing. Build a network of consequences on a board. Taking turns, one representative from each group adds a consequence to the network, aiming to extend each of the lines as much as possible. (20 minutes)

Step 4. Debriefing: Start by asking participants about their experience during the discussions, what did they learn, did they feel included and heard during the discussion and how easy or difficult the task was. Wrap up by asking: "Now that we know how it affects us, what can we do to use screens more healthily?" Take notes of their answers on a flipchart or a board. (20 minutes)
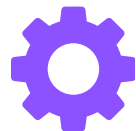
Session 2 | Light Pollution Walk

DURATION:
80 minutes

MATERIALS:
- 360° videos of predefined locationsVideo viewing deviceLeopold Matrix formPens
- Flipchart or notebook for facilitator

EVALUATION METHODS:

- **Participation and Observation:**

The facilitator will evaluate participants' active involvement during the walk and their ability to identify visible examples of light pollution in the environment.

- **Group Discussion:**

Assessment will focus on each participant's contribution to the discussion after the walk, particularly their capacity to describe what they observed and suggest simple improvements based on sustainable lighting principles.

👥 LIGHT POLLUTION WALK – IDENTIFYING SOURCES OF LIGHT POLLUTION (80 MINUTES)

Step 1. Introduction. Divide participants into groups of up to 5 people, provide the materials for the Leopold Matrix, and assign a video for all participants to watch.

Step 2. Short Walk. Conduct a virtual walk through a short 360° video of predetermined locations, identifying sources of light pollution (e.g., streetlights, building lighting, billboards). Alternatively, you can also use Google Maps Streetview for this task. (5 minutes)

Step 3. Identification of Light Pollution Sources. Participants will mark the observed sources and their potential impacts on the Leopold Matrix (material provided within this Curriculum), replaying the video as many times as needed. (30 minutes)

Step 4. Group Discussion. Gather to discuss the findings and initial impressions regarding the use of the Leopold Impact Matrix as a tool. (30 minutes)

Step 5. Debriefing Wrap up the exercise by asking participants was this task easy or difficult for them and why? Continue by asking what have they learned and where and how could they apply this knowledge? Ask them if any of the sources identified were new to them and invite them to share some ideas on how to reduce the impact of these sources. (15 minutes)
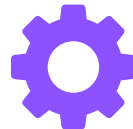
Session 3 | My Life on Screen: Healthy Strategies

DURATION:
90 minutes

MATERIALS:
- Pictogram drawingsPost-itsBoard / whiteboardDry-erase markersPens or pencils

EVALUATION METHODS:
- **Participation in Discussion:** The facilitator will evaluate each participant's engagement in group discussions about screen use and its effects on sleep and health.
- **Identification of Impacts:** Assessment will focus on the participant's ability to recognize the main risks associated with excessive screen time and blue light exposure.
- **Personal Action Plan:** At the end of the session, participants will write or share one personal strategy they commit to applying (for example: reducing screen time before bed, activating night mode, or improving sleep routines). The clarity and relevance of this proposal will be informally reviewed.

👥 MY LIFE ON SCREEN – HOW MUCH TIME DO WE SPEND IN FRONT OF A SCREEN? (40 MINUTES)

Step 1. Opening Question and Brainstorming: Begin the activity by asking: **"How much time do you think you spend in front of a screen each day (phone, tablet, computer, television, video games)?"** Encourage honesty and sharing of examples of their screen-related activities. (10 minutes)

Step 2. Usage Log: Ask participants to write down, on their cards or sticky notes, all the activities they do using screens during a typical day (e.g., "checking social media," "watching series," "doing homework," "playing video games," "chatting with friends," "watching videos," "working"). They should use one sticky note for each activity. (10 minutes)

Step 3. The Screen Wall: Have each participant stick their notes on a designated area of the board or wall. As they place them, ask questions such as: "Is there any activity here that surprises you?" or "Do you notice patterns in the types of activities you do?" This helps visualize the magnitude of screen use. (15 minutes)

Step 4. Introduction to "Impact": Explain that while screens are useful tools, excessive or inappropriate use can have consequences for our health. (5 minutes)

👥 GUIDED EXPLORATION BY AREAS – HOW DOES IT AFFECT US? (50 MINUTES)

Step 1. Divide the board / wall into several sections. Have ready the drawings/pictograms of: **Eyes, Neck/Back, Brain (sleep, concentration), Hands/Wrists, Emotions/Mental Health (provided materials)**. Give each group the images of the body parts and emotions. For each section, ask: **"How do you think screen use could affect this part of the body or this emotion/state?"** (10 minutes)

Step 2. Guide the discussion and if needed provide this information:
1. **Eyes:** Eye strain, dryness, blurred vision (mention **blue light** and reduced blinking).
2. **Neck/Back:** Neck pain, "text neck" hump, poor posture (mention posture).
3. **Brain (sleep and concentration):** Difficulty sleeping (blue light tricks the brain), decreased concentration, difficulty remembering.
4. **Hands/Wrists:** Tendinitis, "text-thumb", joint pain, arthritis.
5. **Emotions/Mental Health:** Anxiety, depression (social media comparison), irritability, social isolation, nomophobia (fear of being without a phone). Mention the reward circuit and addiction, as well as instant gratification and dopamine overflow.

If available, show photo slides with each of the above-mentioned effects.

As each is discussed, write the key effects under the corresponding section. (20 minutes)

Step 3. Practical Case: Start by dividing participants into groups up to 4 participants in each. Use creative energizers available in Module 2 for this. Using the case cards (see annex), give one to each group. Ask them to read the case and discuss what health effects the characters might be experiencing due to screen use. They should note down their answers. Alternatively, you can use a rotating discussion where 1 participant always stays in the same group and acts as a moderator that writes down the notes and conclusions, while the rest move clockwise, so that all participants have a chance to contribute to each case discussion. The facilitator can call out "Change" every 5 to 7 minutes or use some gesture to indicate that it's time to change groups (such as clapping). Tell participants that they have approx. 20 to 25 minutes for discussions. Once the discussions are finished invite the moderators to share key insights and conclusions from each case with 5 to 10 minutes available for all group sharing. (30 minutes)

Step 4. Debriefing: Start by asking participants about their experience during the discussions, what did they learn, did they feel included and heard during the discussion and how easy or difficult the task was. Wrap up by asking: **"Now that we know how it affects us, what can we do to use screens more healthily?"** Take notes of their answers on a flipchart or a board. (20 minutes)
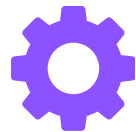
Session 4 | Circadian Cycles

DURATION:
105 minutes

MATERIALS:
- Timer (can be from a cellphone)
- Board / whiteboard
- Dry-erase markers
- Post-its
- Pens

EVALUATION METHODS:
- **Participation in Guided Discussion:** The facilitator will evaluate active participation during explanations and group dialogue about how artificial light affects circadian rhythms and overall health.
- **Concept Understanding:** Assessment will focus on participants' ability to explain, in simple terms, what the circadian rhythm is and how it relates to light exposure and sleep quality.

Session 4 | Circadian Cycles

👥 UNDERSTANDING CIRCADIAN CYCLES – HOW DOES OUR BIOLOGICAL CLOCK WORK? (60 MINUTES)

Step 1. Start the session. In an open space, invite participants to stand, close their eyes, and begin breathing slowly and deeply—inhale through the nose for 5 seconds, bringing the air to the abdomen, hold it for 4 seconds, and then exhale slowly through the mouth. Repeat this breathing pattern three times. With eyes still closed, invite all participants to notice the natural light they are receiving—register where in their bodies they most strongly perceive the arrival of light. (3 minutes)

Then, ask them to mentally count two minutes. When they believe two minutes have passed, they should open their eyes and raise their right hand. Record who opened their eyes before the time was up and group them together in one area. Those who were close to the two minutes (± 10 seconds) should be grouped in another area, and those who opened their eyes after two minutes in yet another. Explain to the participants why they are in each group. Make sure to start your own timer in order to follow the time correctly. (4 minutes)

Step 2. Trigger question: Begin the activity by asking participants: **"Have you ever felt sleepy at a specific time of day, even if you slept well the night before**? Or **have you noticed it's harder to fall asleep if you go to bed very late one day and very early the next?"** (3 minutes)

Step 3. Presentation of the Concept: Introduce the term "Circadian Cycle." Explain that "circa" means "around" and "dies" means "day," so it is a cycle that lasts approximately 24 hours. You can use the metaphor of an "internal clock" that we all have in our brains. This clock tells us when we should feel sleepy and when we should be awake. Mention that light is the main synchronizer of this clock. When there is light, our brain understands that it is daytime and keeps us active. When it gets dark, our brain begins preparing us for sleep. (10 minutes)

Step 4. Drawing the "Circadian Clock": On the board, draw a large circle, like the face of a clock. Divide it into 24 segments (one for each hour), though it doesn't have to be perfectly precise—just representative. Label some key times (e.g., 6 AM, 12 PM, 6 PM, 12 AM). (5 minutes)

Step 5. Activity Identification: Give each participant cards or sticky notes. Ask them to write or draw different activities they do during a typical day (e.g., waking up, having breakfast, going to school/work, having lunch, exercising, having dinner, watching TV, reading, showering, going to bed, sleeping, waking up at night). Also, ask them to include sensations or states (e.g., high energy, low energy, hunger, sleepiness, alertness). (15 minutes)

Step 6. Positioning Activities on the Clock: Invite participants to place their cards on the drawn "Circadian Clock," positioning them at the approximate time they usually perform those activities or experience those sensations.

Step 7. Guide the Discussion: While they do this, ask questions such as: "**At what time do you usually feel the most energy?**" "**When do you first start feeling sleepy at night?**" "**What time do you like to have dinner?**" "**When do you think your body is most prepared for deep sleep?**" "**When is it easiest for you to wake up?**" (15 minutes)

Step 8. Focus on Key Points of the Cycle: Highlight how, for example, melatonin (the sleep hormone) begins to be produced when it gets dark, and cortisol (the stress hormone that keeps us alert) is highest in the morning. You can use images to represent day and night on the clock.

Step 9. Identifying the "Sleep Window": Help participants identify an 8–9-hour period on the clock where most activities are related to sleep. Explain that this is the optimal period for sleep for most people. (5 minutes)

Step 10. Group Discussion: Ask participants: "**What things do you think can 'confuse' our internal clock and disrupt our circadian cycle?**" (15 minutes)

Step 11. Idea Generation: Write their answers on the board. Guide them to mention: (15 minutes)
1. Use of screens before sleeping (blue light).
2. Irregular sleep schedules (going to bed very late one day and very early the next).
3. Eating dinner very late or having heavy meals before sleeping.
4. Consumption of caffeine or energy drinks in the afternoon/evening.
5. Incorrect lighting in the sleeping area.
6. Very long or late naps.
7. Stress or worries.
8. Traveling to different time zones.

Step 12. Explanation of the Consequences: Briefly explain how these actions can affect the internal clock, making it harder to fall asleep, causing people to wake up tired, or feel sleepy during the day. (5 minutes)

Step 13. Brainstorming: Ask participants: "What can we do to help our internal clock work properly and ensure good sleep?"

Step 14. Collecting Tips: Write the suggestions on the board, adding ideas such as:

1. Establish a regular bedtime and wake-up schedule, even on weekends.
2. Get exposure to natural light in the morning.
3. Avoid screens and bright or white lights before sleeping.
4. Create a relaxing bedtime routine.
5. Exercise regularly, but not right before sleeping.
6. Avoid heavy meals, caffeine, and alcohol at night.
7. Keep the bedroom dark, quiet, and cool.

(15 minutes)

Module 4

Technical Solutions and Design of Sustainable Nightlife Spaces

Technical Solutions and Design of Sustainable Nightlife Spaces

Module 4 of this curriculum focuses on understanding and applying the principles of sustainable urban lighting. Participants are introduced to the concepts of Light Urbanism and Urban Lighting Plans, exploring how thoughtful lighting design can improve public safety, reduce light pollution, and foster nighttime social life while protecting biodiversity and heritage. The module highlights the importance of aligning lighting with community needs and urban dynamics.

Through guided and work-based learning activities, students will engage in participatory mapping of nighttime environments, analyze local lighting conditions, and reflect on their impact on human behavior and ecological systems. Case studies and interactive sessions allow participants to examine different types of urban lighting—functional, architectural, green infrastructure, and artistic—and understand their role in shaping inclusive, healthy, and vibrant nighttime cities.

By the end of the module, learners will be equipped to design basic lighting proposals adapted to specific neighborhoods, integrating social, cultural, and environmental considerations. The module encourages creative expression through Light Art and introduces participatory tools that empower communities to contribute to nighttime urban planning. This hands-on approach builds both technical and civic skills for sustainable urban lighting solutions.

Module 4

Objectives:
- Understand and apply the principles of sustainable urban lighting by analyzing nighttime urban environments and proposing lighting solutions that balance social use, ecological protection, and urban identity.
- Develop participatory and creative lighting proposals that respond to local needs and contexts, incorporating functional, architectural, green, and artistic approaches to urban lighting.

Planned learning outcomes:
At the end of this module, participants will be able to:
1. Describe the historical evolution and purpose of public lighting, and explain how lighting impacts urban safety, energy use, and environmental quality.
2. Analyze the lighting conditions of a specific neighborhood by identifying bright and dark zones, key landmarks, public facilities, circulation paths, and areas perceived as safe or unsafe.
3. Differentiate between types of urban lighting (functional, architectural, green structure, and light art) and assess their application in real or simulated urban settings.
4. Design a lighting proposal for a neighborhood or public space, integrating contextual needs, sustainable principles, and lighting typologies in a collaborative format.
5. Develop and present a creative light art concept that expresses a social or spatial issue using lighting as a medium.

Duration:
6 hours

Module 4

Theoretical basics	Guided and work-based learning	Independent learning	TOTAL
Session 1	2 hours 30 minutes	30 minutes	3 hours
Session 2	2 hours 30 minutes	30 minutes	3 hours
			6 hours

Literature and specific teaching aids required for the realization of the module:

1. Tondelli, S., Conticelli, E., Marzani, G., Kozlova, I., Slater, D., Bordonaro, E., McDaid, D., Burton-Page, M., Van Der Pol, J., & Brons, J. (2025). Urban lighting for health and wellbeing: new guidelines. LUCI Association. https://doi.org/10.5281/zenodo.15348443
2. Usobiaga, E., Egusquiza, A., de Agustin Camacho, D. P., Benedito-Bordonau, M., & López de Aguileta Benito, A. (2024). Empleo de diferentes tecnologías de información geoespacial para el análisis de la iluminación en entorno urbano y su impacto en la ciudadanía. Actas Del XX Congreso De Tecnologías De La Información Geográfica. Tecnologías De La Información Geográfica Para La Construcción De Territorios Inteligentes., 209-215. https://doi.org/10.21138/tig.2024.lc

Module 4

3. Slater, D., Bordonaro, E., & Entwistle, J. (2025). Policy brief: Social lighting for quality of life in public space. Zenodo. https://doi.org/10.5281/zenodo.14930991
4. Slater, D., Bordonaro, E., & Entwistle, J. (2025). Policy brief: Community engagement for designing innovative urban lighting solutions. Zenodo. https://doi.org/10.5281/zenodo.14931025
5. Edited by Don Slater, Elettra Bordonaro, Joanne Entwistle, with a contribution by Isabelle Corten. Configuring Lighting, The London School of Economics and Political Science, The London School Sociology, LSE Cities, King`s College Lomdon, iGuzzini.
6. Social Lightscapes Workshops. Social research in design for lighting professionals. https://www.iguzzini.com/news/download-social-lightscapes-workshops,-a-research-paper-by-configuring-light-(lse)/
7. Edited by Dr Navaz Davouddian. Urban Lighting for People: Evidence - Base Lighting Design for the Built Environment. ISBN 978 1 85946 821 0/ 978 1 85946 822 7
8. A project initiated and developed by Beforelight. Urban Lightscapes. ISBN 978-61-8819-120-4 beforelight.gr, urbanlightscapes.net
9. Rodríguez Lorite, Miguel Ángel, con la colaboración de Guida Ferrari y Ada Martín. El Paisaje Nocturno y la Iluminación en los Centros Históricos urbanos. Ed. Intervento RED. ISBN: 978 84 942690 0 4
10. VIA-Verlag, Joachim Ritter e.K. PLDC 2017. The Future of Urban Ligthing: The visions of eight Masters of Lighting Design Results of the Design Ideas Competition 2017. ISBN: 978-3-9811940-7-4
11. Florian, Maria-Cristina. A Brief History of Illumination in Public Spaces: The Safety of Light: A Short History of Light in Public Spaces. Published on March 23, 2023. https://www.archdaily.com/998418/the-safety-of-light-a-short-history-of-light-in-public-spaces
12. Original essay by Roger Narboni, translated from the French portrait by Antoine Doyen. "Imagine the Future of the City at Night" https://www.concepto.fr/wp-content/uploads/2020/06/AL-FEV-2017.pdf
13. Narboni, Roge. "From light urbanism to nocturnal urbanism".

Module 4

14. https://www.researchgate.net/publication/312062966_From_light_urbanism_to_nocturnal_urbanism
15. CIE 234:2019A Guide to Urban Lighting Masterplanning. ISBN 978-3-902842-16-9 https://cie.co.at/publications/guide-urban-lighting-masterplanning
16. LUCI Declaration for the Future Urban Planning. https://www.luciassociation.org/luci-declaration-for-the-future-of-urban-lighting/
17. Relevant Case Studies: Cities & Lighting Magazine https://www.luciassociation.org/luci-publications/
18. Carta de Taxco https://www.academia.edu/33626484/Carta_taxco
19. Rodriguez Lorite, Miguel Ángel, Guía Eficiente de Monumentos. https://www.madrid.org/bvirtual/BVCM015700.pdf
20. Laganier,Vincent. "Lyon Ville Lumiere" https://lightzoomlumiere.fr/wp-content/uploads/2013/11/Lyon-ville-lumi%C3%A8re-MondoArc23-2005-.pdf
21. Annika K. Jägerbrand, Constantinos A. Bouroussis. Ecological Impact of Artificial Light at Night: Effective Strategies and Measures to Deal with Protected Species and Habitats. https://www.researchgate.net/publication/351903870_Ecological_Impact_of_Artificial_Light_at_Night_Effective_Strategies_and_Measures_to_Deal_with_Protected_Species_and_Habitats
22. https://darksky.org/resources/guides-and-how-tos/lighting-zones/
23. Michele W McColgan, John D. Bullough, John Van Derlofske, Mark S. Rea, LESS: Luminarie Evaluation and Selection Systemstem. https://www.lrc.rpi.edu/programs/transportation/pdf/LRC-LESSReport.pdf
24. The workshop 'Urbanismo luz' (Urban Lighting) made in Medellín under the direction of lighting designers Roger Narboni and Pascal Chautard: https://www.archdaily.co/co/758924/esbozo-de-un-plan-maestro-de-iluminacion-para-la-ciudad-de-medellin-y-el-valle-de-aburra-colombia?ad_campaign=normal-tag

Session 1 | Urban Lighting: From Origins to Planning

DURATION:

180 Minutes

MATERIALS:

- Maps of a neighborhood
- Photos of the neighborhood
- Color printer and paper (if budget allows)
- Translucent sheets (tracing paper)
- Markers and colored pencils
- Cardboard and glue
- Translucent colored sheets (cellophane paper)
- Suggested slides
- Flashlights, spotlights, or LED strips

EVALUATION METHODS:

Evaluation methods for this module are presented at the end of session 2.

👥 UNDERSTANDING USER NEEDS AND CONTEXT:

- **Slide 1 - 5 min**

Presentation of the Educator/facilitator and the topic

- **Slide 2 - 10 min**

Start by asking these two questions: What are the imaginary concepts about night? What activities do people engage in at night?; and tell participants to write down their answers on a sheet of paper:
  1. Invite several participants or the whole group (depending on the total number of participants) to read the answers aloud. Reflect with the participants on the meanings of night.

- **Slide 3 - 30 min**

Using energizers from Module 2 form small groups of 3 or 4 people in each and tell them to discuss their neighborhoods at night, answering the following questions:
  1. How do you feel about your neighborhood at night?
  2. Can you describe different lighting and dark zones?
  3. Are there green spaces or nature reserves in your neighborhood? Can you walk near them at night or early in the morning?
  4. How would you describe what 'well-lit area' means?
  5. How would you describe what 'poorly lit area' means?
  6. Does the light from the street lamps shine through the windows of your house?

MAPPING THE NIGHT:

- **Slide 4 - 1 hour:**

The educator / facilitator should previously select a neighborhood and take nighttime photos of the area that is familiar to most participants.

The educator / facilitator should also prepare 5 or 6 printed maps of this place and provide them to the participants along with the photos.

Using group division exercise available in Module 2 od this Curriculum split the participants into small groups with 3 or 4 people in each to work on the same neighborhood.

If this is not possible, form groups with participants from the same city and select a neighborhood (preferably one that they may visit later). If participants are not from that neighborhood, they can explore it using Google Maps.

Provide the participants with different colorful markers, printed maps, photos and paper. Tell them they need fulfill the following tasks, using printed maps or papers, depending on the task.

Make sure to prepare the list with tasks before the exercise and handout them on a piece of paper to each group. You can also write down all tasks on a flipchart or showcase it on a screen, but make sure all tasks are visible to every group. Tell them they have up to one hour for this activity.

List of tasks:

- Are you a resident of this neighborhood or a visitor?
- Use one color to mark the green areas, including parks or places where people spend the most time.
- Use another color to mark the iconic or emblematic buildings.
- Use another color to mark the points where people access public transportation.
- Mark the brightest zones with one color and the darkest zones with another.
- Mark on the map the restaurants, pubs, food markets, or food trucks that are open at night, and highlight any that make you feel safer.
- Identify urban facilities such as hospitals, universities, or government institutions, especially those operating night shifts.
- If you are familiar with the neighborhood, indicate which areas you perceive as safe and unsafe at night.
- Indicate what activities you do during the day in the places marked with one color, and what activities you do at night. Use another color to mark them and outline your routes.

- **Slide 5 - 30 min**

Continue working in the same small groups and introduce participants with new set of questions shown either on a flipchart or screen.

If the maps provided in previous step are already full of information, provide them with another one of the same neighborhoods.
1. Identify the brightest zone. What activities are associated with this area? Is it the most frequented gathering place?
2. Identify the darkest zone. What activities take place there? Is it associated with areas perceived as unsafe?
3. Determine whether the areas where people access public transportation are well-lit or dark.
4. For city dwellers: How bright or dark is your pedestrian path from home to the transportation station?
5. For those unfamiliar with the neighborhood: Search for photos online and try to assess how bright or dark the paths to transportation stations appear.

THE ORIGIN OF PUBLIC LIGHTING

- **Slide 6 - 15 min**

Activity: "Concepts and Key points": The educator/facilitator should previously read the suggested bibliography and the notes attached to the presentation on the slide 6, to deliver a brief introduction on the origin of public lighting, considering key developments from the 15th century to the present day.

Florian, Maria-Cristina.The Safety of Light: A Short History of Light in Public Spaces. https://www.archdaily.com/998418/the-safety-of-light-a-short-history-of-light-in-public-spaces

Gas Lighting https://en.wikipedia.org/wiki/Gas_lighting#

Important Considerations to Emphasize
1. We have created light for our safety: first with fire, and later as cities developed. With the introduction of street lanterns, we tried to make nighttime public spaces resemble the daytime. This desire marked the beginning of light pollution.
2. Many policies aim to increase lighting in public spaces to improve safety, but more light does not necessarily mean greater safety.
3. Today, we have different sources of light, some more efficient than others. However, regardless of efficiency, it is the proper direction of lighting that largely prevents pollution.

👥 URBAN LIGHTING PLAN, LIGHTING URBANISM:

- **Slide 7 - 15 min**

Activity: "Concepts and Key points": The educator/facilitator should previously read the suggested bibliography and the notes attached to the presentation on the slide 7, to deliver a brief introduction on the meaning of Urban Lighting Plan or Light Urbanism

Narboni, Roge. "From light urbanism to nocturnal urbanism".
https://www.researchgate.net/publication/312062966_From_light_urbanism_to_nocturnal_urbanism.

_Zielinska-Dabkowska, Karolina M._ Urban lighting masterplan - origins, definitions, methodologies and collaborations.
https://open.icm.edu.pl/items/1d3911d1-d70a-43d2-9564-edce3dfb4123

Lighting Master Plan Lyon
https://www.lyon.fr/actions-et-projets/les-plans-daction-strategiques/le-plan-lumiere-prendre-soin-de-la-nuit
Ottaviani, D., Conticelli, E., & Biscarini, C. (2024). Illuminazione e salute: uno studio comparativo dei Lighting Masterplans. Temi ricorrenti e approcci condivisi. Servizi, Dotazioni Territoriali, Welfare E Cambiamenti Sociodemografici. Atti Della XXV Conferenza Nazionale SIU., 08, 275-280. https://doi.org/10.5281/zenodo.14975226
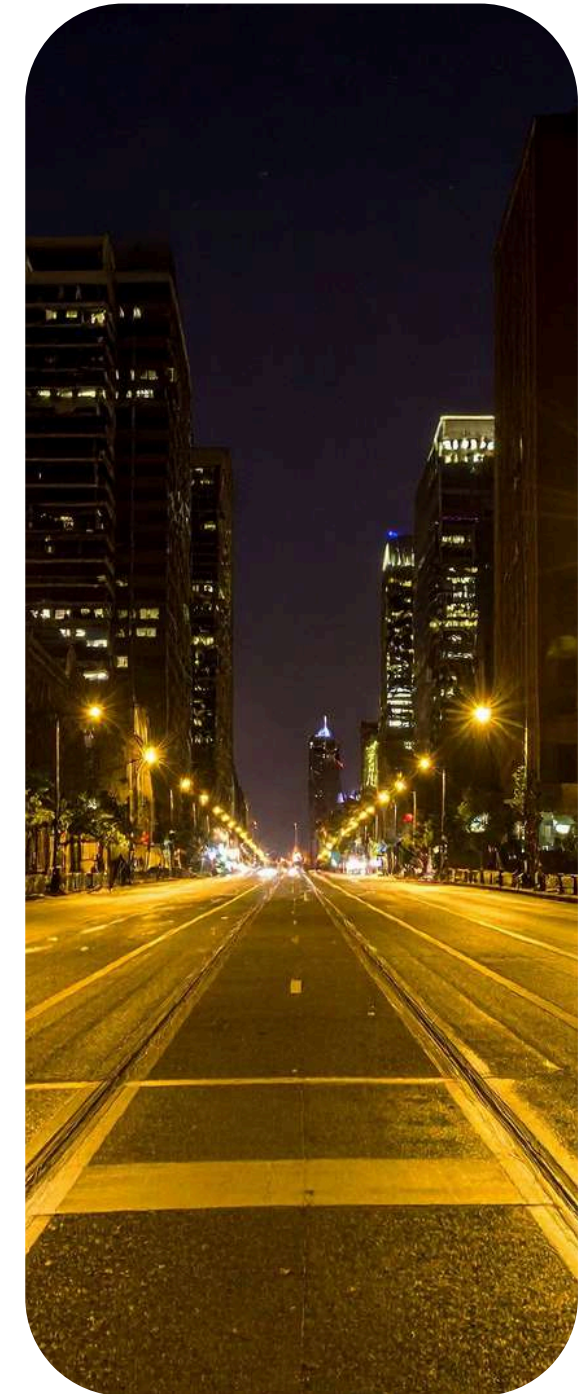
Some thoughts to consider:

- A Lighting Master Plan links urban lighting systems to urban planning studies.
- *Lighting Urbanism* focuses on holistic studies that provide a nighttime landscape, including urban lighting for roads and public spaces, green areas, luminous environments for pedestrians, and the enhancement of historical, modern, and contemporary architecture.
- Lyon is one of the best examples of Master Plan implementation. It is now in its third version, with a special emphasis on sustainable lighting in this latest edition.

DURATION:

180 Minutes

MATERIALS:

- Maps of a neighborhood
- Photos of the neighborhood
- Color printer and paper (if budget allows)
- Translucent sheets (tracing paper)
- Markers and coloured pencils
- Cardboard and glue
- Translucent colored sheets (cellophane paper)
- Suggested slides
- Flashlights, spotlights, or LED strips
- Materials for Light Art (budget-flexible)

- Light sources: small flashlights, clip-on lamps, LED tea lights, phone flashlights (as backup)

- Translucent/reflective materials: tracing paper, baking parchment, tissue paper, cellophane, plastic folders, acetate sheets, mylar, aluminum foil
- Color filters: colored gels, cellophane, markers on acetate
- Structure/building: cardboard, wire, bamboo skewers, tape, binder clips, clothespins, string, glue sticks
- Surfaces: white/neutral walls, foam boards, sheets for projections
- Drawing/modeling: paper, markers, pencils, scissors, cutting mats
- Optional tech: small mirrors, magnifying lenses, simple prisms
- Safety: low-heat LEDs preferred; if using mains lamps, provide power strips and tape for cables

EVALUATION METHODS:

Quantitative assessment with a 4-question quiz

1. List the four types of urban lighting.
2. Describe the steps to develop an urban lighting plan.
3. What are the benefits of an urban lighting plan?
4. How does an urban lighting plan help prevent light pollution?

Qualitative assessment:

- Evaluation of the group activity presentations.

TYPES OF URBAN LIGHTING - FUNCTIONAL:

- **Slide 9 - If the facilitator considers appropriate**

- **Slice 10 - 15 min**

Review the slide, the notes, and the bibliography about Functional Urban Light

1. *CIE 234:2019, Guide for Master Planning of Urban Lighting, which provides guidance on the fundamental objectives and principles related to aspects of urban nightscape*
2. *CIE 150:2017, the aim is to limit the effects of intrusive light on nearby properties and the potential negative effects on tree species.*
3. *CIE 115:2010, Recommendations for the Lighting of Roads for Motor and Pedestrian Traffic*
4. *Local Regulations (RETILAP- COLOMBIA, Norma de Emisión de Luminosidad Artificial Generada por Alumbrado de Exteriores - CHILE, EN 13201- Europe)*

It is important to highlight and reflect on:

1. Local and international regulations regarding road and intersection lighting ensure road safety and provide visual comfort for drivers, pedestrians, and cyclists.
2. The need to comply with local requirements while preserving the urban environment. Functional lighting should be coordinated with other types of lighting without compromising its role within space.

TYPES OF URBAN LIGHTING - ARCHITECTURAL AND MONUMENTAL LIGHTING

- **Slide 11 - 15 min**
1. Review the slide, the notes, and the bibliography about Architectural and Monumental Lighting
2. *Carta de Taxco https://www.academia.edu/33626484/Carta_taxco*
3. *Rodriguez Lorite, Miguel Ángle, Guía Eficiente de Monumentos. https://www.madrid.org/bvirtual/BVCM015700.pdf*
4. *Laganier,Vincent. "Lyon Ville Lumiere" https://lightzoomlumiere.fr/wp-content/uploads/2013/11/Lyon-ville-lumi%C3%A8re-MondoArc23-2005-.pdf*

Some thoughts to consider
- Lighting proposals can be developed for contemporary buildings, but the bibliography mainly refers to architectural heritage buildings, as they are the most regulated in terms of lighting.
- It is important to distinguish between architectural lighting (generally static or with slight variations) and media architecture (which involves dynamic graphic projections of text or images).
- Lighting enhances monuments, façades, and architectural elements, helping create a visual identity. Potential buildings for illumination must be assessed according to their importance, using criteria such as function, historical significance, appearance, aesthetic quality, symbolic value, architectural features, silhouette effect, visibility, and promotional impact. Regulations under special heritage management plans must also be verified.
- For heritage sites located in downtown areas, it is necessary to check whether the existing lighting (including luminaires and color temperature) forms part of the historical identity or whether a survey of the existing fixtures is required.
- Each building must be specifically assessed to ensure that cable layouts and lighting fixtures do not cause physical damage or distort the historical meaning and traditional appearance of the structure

TYPES OF URBAN LIGHTING - GREEN STRUCTURE

- **Slide 12 - 15 min**
1. Review the slide, the notes, and the bibliography about the Lighting in Green Structure
2. *Annika K. Jägerbrand, Constantinos A. Bouroussis. Ecological Impact of Artificial Light at Night: Effective Strategies and Measures to Deal with Protected Species and Habitats. https://www.researchgate.net/publication/351903870_Ecological _Impact_of_Artificial_Light_at_Night_Effective_Strategies_and_M easures_to_Deal_with_Protected_Species_and_Habitats*
3. *https://darksky.org/resources/guides-and-how-tos/lighting-zones/*
4. *Michele W McColgan, John D. Bullough, John Van Derlofske, Mark S. Rea, LESS: Luminarie Evaluation and Selection Systemstem. https://www.lrc.rpi.edu/programs/transportation/pdf/LRC-LESSReport.pdf*

Some thoughts:

- It is recommended to classify by zones (see https://darksky.org/resources/guides-and-how-tos/lighting-zones/), specifying the levels and luminaires that designers may use based on local requirements and the intended use of the green area.
- Local environmental protection laws should be reviewed, with a focus on ensuring progress in halting biodiversity loss and promoting its recovery.
- Although there is no international consensus on how to manage green areas, and research is still ongoing regarding the impact of certain light spectra on fauna and flora, the following general recommendations are made: Outdoor lighting proposals should use low-energy luminaires with a hemispheric index greater than 0%. For public gardens, low-energy, low-level lighting is recommended. In environmentally sensitive areas, artificial outdoor lighting should be kept to the minimum necessary and switched on only when needed. The light should not be brighter than required, and blue light emissions should be minimized (with a color temperature not exceeding 3000 K).

TYPES OF URBAN LIGHTING - LIGHT ART

- **Slide 13 - 15 min**
1. Review the slide, the notes, and the bibliography about Light Art
2. *A publication from the LUCI Light & Art Commission chaired by the City of Gothenburg. Light and Art in Public Spaces.*
   https://www.luciassociation.org/wp-content/uploads/2024/02/LUCI-Publication-Light-Art-in-Public-Spaces.pdf
3. *Review Quarties des spectacles:*
   https://www.quartierdesspectacles.com/fr/portfolio/lumino

Reflections:
- Light art is a tool for revitalizing cities, which can be applied in the most unsafe or critical areas to attract regular visitors to these spaces.
- Such initiatives can become connecting points between different locations or neighborhoods and serve as a way to make the night more enjoyable and vibrant.

A SOCIAL AND CULTURAL PERSPECTIVE OF LIGHTING URBANISM OR URBAN LIGHTING:

- **Slide 14 - 15 min**
1. Review the slide, the notes, and the bibliography about when approaching Urban Lighting from a social perspective, the focus is on needs and there is no waste of lighting.
2. *Edited by Don Slater, Elettra Bordonaro, Joanne Entwistle, with a contribution by Isabelle Corten. Configuring Lighting, The London School of Economics and Political Science, The London School Sociology, LSE Cities, King`s College Lomdon, iGuzzini. Social Lightscapes Workshops. Social research in design for lighting professionals https://www.iguzzini.com/news/download-social-lightscapes-workshops,-a-research-paper-by-configuring-light-(lse)/*
3. *Edited by Dr Navaz Davouddian. Urban Lighting for People: Evidence - Base Lighting Design for the Built Environment. ISBN 978 1 85946 821 0/ 978 1 85946 822 7*

Think about it with the students
- Review diverse needs, socio-cultural perspectives, and spatial planning.
- Encourage public participation to improve the lighting environment and create better nighttime conditions.
- Everyone has something to say about light, giving the city an opportunity to involve inhabitants in co-designing the public realm.
- The importance of the quality of social interaction in our daily lives is widely recognized as a key factor in the design of environments.
- Who interacts with the lit environment? Urban lighting must provide a continuous transition in response to ever-changing human behavior.

👥 STEPS OF AN URBAN LIGHTING PLAN

- **Slide 15 - 21, 45 min**
1. Review the slide, the notes, and the bibliography Recommendations to formulate an Urban Lighting Plan
2. *CIE 234:2019A Guide to Urban Lighting Masterplanning. ISBN 978-3-902842-16-9 https://cie.co.at/publications/guide-urban-lighting-masterplanning*
3. *Rēzija Sabīne Jurševska. Urban nightscapes and lighting master plans. Case study of Liepāja. https://journals.llu.lv/laa/article/view/70*

⚙️ **You can explore this topic further in:**
- Diagnosis of the current state of the city at night: identifying bright and dark areas, residential, commercial, sports, and green spaces, city landmarks, urban facilities, transport stations, and historic or heritage buildings. Above all, consider how the neighborhood or city connects with people at night.
- How can I develop and communicate the lighting strategy? Based on clear objective and identified opportunities, a concept can be created that enables the strategy to be effectively communicated and implemented. *(Review the examples on the slides.)*

INITIATIVES:

- **Slide 22-24, 1 hour**
1. Explain the different initiatives and scales that can be developed in terms of urban lighting and make a ***call to action***. The teacher or facilitator may either choose one of the two activities or divide the class into two groups, with each group carrying out one initiative.
2. For this topic, review this bibliography about:
3. The workshop 'Urbanismo luz' (Urban Lighting) made in Medellín under the direction of lighting designers Roger Narboni and Pascal Chautard: https://www.archdaily.co/co/758924/esbozo-de-un-plan-maestro-de-iluminacion-para-la-ciudad-de-medellin-y-el-valle-de-aburra-colombia?ad_campaign=normal-tag

Urban Lighting Acupuncture 1 - hour

(This activity is recommended for groups of students with more advanced knowledge of architecture and urban planning)
Divide participants into small groups of 3 to 4 people in each. Their task is to draw on the pictures and maps, based on the following questions. You can print out the task and hand it out to each group, or show it on a flipchart or screen. Allocate 45 minutes for the task.

- Choose a square, a park, or an iconic spot in the neighborhood you have been analyzing in previous session. According to the needs and contextual preferences, what kind of lighting would you use in public space? Indicate on the map how you would like it to be lit, defining areas to remain dark and highlighting points of attraction in the city during nighttime.
- Choose a concept that represents this dynamic or use colors to indicate different lighting levels you want for the area on the map or on a photo that reflects the nighttime image you aim to achieve. Artificial light extends activity time; through colors, contrasts, directions, and intensities, it emphasizes, organizes, and dramatizes. How would you like people to experience the light in this place?
- Use the photos as a guide and illustrate what the nighttime image of your proposal would look like. If you have the right tools, you may also edit the photos. On the map, mark how you think people would use and interact with the environments they occupy.

After they are finished, tell them to put their drawings on the wall or a string and create a group exhibition with the results. Allocate 5 minutes for everyone to walk around and look at all the drawings. Return to plenary and wrap up by asking questions such as – what did they learn from this exercise and how they can use the gained knowledge. You can also ask participants what would they change or add on other groups' drawings or comment what they think of them. Provide 10 minutes for debriefing.

Light Art - 1 hour

Small-Group Light Art Project: Designing Solutions for Public Space

Purpose of the activity:

- Create a collaborative light-based artwork that symbolizes a solution to a local public-space problem.
- Practice creative problem-solving, visual communication, teamwork, and iterative design.
- Reflect using Kolb's experiential learning cycle.

Step-by-Step

1) Introduction and Framing (5 minutes)

- Brief the challenge: Design a light-based artwork that conveys a poetic solution to a real neighborhood/public-space problem (e.g., safety at night, litter, lack of green space, isolation, wayfinding).
- Emphasize exploration: contrast, shadow, translucency, color, reflection.

2) Form Small Groups (5 minutes)

- Divide participants into groups of 3–4 people per each. Tell them they have the following role in each group (participants can rotate / switch roles as needed):
  - Problem Mapper: gathers neighborhood issues and stories.
  - Visual Composer: sketches and arranges materials.
  - Light Director: tests light angles, intensity, filters.
  - Documenter/Presenter: captures photos/notes; prepares the pitch.

4**) Build and Prototype (15 minutes)**
- Construct a small-scale model or vignette.
- Test multiple lighting setups:
 - Move lights closer/farther, change height, add filters.
 - Note how the imagery changes and what best communicates the idea.
- Capture final photos/video for documentation.

5) Showcase: Mini-Gallery Walk (10 minutes)
- Each group presents:
 - The public-space problem and poetic solution.
 - How light transforms the piece (demonstrate with lights).
 - One key iteration insight.

6) Debrief (15 minutes)
Start the debriefing process. Use the following questions during debrief:
- What did you make and how did it behave under different lighting conditions?
- Which materials and light positions produced the most compelling effects?
- How did the artwork's mood or message shift with color, intensity, or angle?
- What surprised you during testing or the gallery walk?

- What principles about light and perception did you derive? (e.g., edge definition via grazing light, translucency vs. opacity, color mixing)
- How does a poetic metaphor help communicate a complex public-space solution?
- If you scaled this to your neighborhood, what would you change in materials, placement, or interaction?
- Identify one quick real-world test you could run in the next week (e.g., temporary projection on a wall, lantern path demo, community feedback pop-up).

Facilitator Tips
- Keep it safe: Prefer LEDs; avoid hot bulbs; tape down cables; maintain clear walkways in low light.
- Encourage constraints: Limit groups to two light sources at a time to force intentional choices.
- Support equity of voice: Rotate roles during testing; use "1-minute think, 2-minute share" prompts.
- Offer starter prompts: Safety, wayfinding, welcoming atmosphere, environmental stewardship, play, community identity.
- Provide high-contrast materials and tactile options.
- Allow seated workstations and adjustable light heights.
- Offer verbal descriptions during the gallery walk.
- Permit digital sketching or AR flashlight apps if fine-motor tasks are challenging.

Low/No-Budget Adaptations
- Use phone flashlights and paper filters colored with markers.
- Recycle translucent packaging, plastic bottles, and foil.
- Project onto a white sheet or hallway wall.
Optional: Documentation - Compile photos and concepts with captions.

Module 5

Community Action and Multi-Level Governance

Community Action and Multi-Level Governance

This module provides participants with tools to take collective action against light pollution through communication, governance, and leadership strategies. Building on foundational concepts introduced in previous modules, this module emphasizes the power of community-led initiatives and intersectoral coordination to promote awareness and implement sustainable lighting practices.

Participants will explore how to design impactful communication campaigns, understand the structure and roles involved in nighttime governance, and learn how to draft practical instruments such as regulations, competitions, and lighting projects. Through case studies from diverse countries and organizations, learners gain insight into real-world examples of collaborative governance and advocacy.

Finally, the module guides participants in developing an assertive pitch using the Public Narrative framework. This final exercise strengthens their ability to engage others in meaningful dialogue and motivate collective action towards the protection of the night sky. The module combines theoretical content with hands-on learning activities across a 6.5-hour program.

Module 5

Objectives:
- Strengthen the understanding of light pollution and its impacts through community-driven communication strategies and awareness campaigns.
- Develop proposals and advocacy tools—such as governance initiatives, regulations, and assertive pitches—to foster multi-level cooperation in preventing and mitigating light pollution.

Planned learning outcomes:
At the end of this module, participants will be able to:
1. Identify and describe key concepts and types of light pollution, recognizing its effects in local contexts and reflecting on everyday situations where it occurs.
2. Design a communication campaign aimed at raising awareness about light pollution using plain language and context-sensitive strategies.
3. Analyze the roles involved in nighttime governance and collaborate in simulating a multi-actor governance strategy to address light pollution.
4. Structure a basic proposal (regulation, competition, or project) to prevent or mitigate light pollution, considering its components and purpose.
5. Build and present a public narrative-based pitch that communicates a shared purpose and calls others to act against light pollution.

Duration:
6 hours 30 minutes

Module 5

Theoretical basics	Guided and work-based learning	Independent learning	TOTAL
Session 1: Brief Summary	45 minutes	15 minutes	1 hour
Session 2: Communication Campaigns	45 minutes	45 minutes	1 hour and 30 minutes
Session 3: Governances and roles	45 minutes	45 minutes	1 hour and 30 minutes
Session 4: How to structure a proposal?	45 minutes	45 minutes	1 hour and 30 minutes
Session 5: Create an assertive pitch	15 minutes	45 minutes	1 hour
			6 hours 30 minutes

Module 5

Literature and specific teaching aids required for the realization of the module:

- **Presentation:** Find the link of the presentation for the guided learning for all chapters of the module 4. In the speaker notes there are some links included to go deeper into the topics covered in each slide. https://docs.google.com/presentation/d/1DomjM0s6ThB6sVyF2Y832QWfUDoQaHb1/edit?usp=sharing&ouid=110820941423954766874&rtpof=true&sd=true

- **Activities:** Links to suggested formats for work-based learning activities are included. While these formats are designed for both group work and independent work, the instructor will answer questions during the work-based learning process to ensure the objective of each activity is met.

- **Formats for activities 1,2,3** -print size 70centimeters*50centimeters-: https://docs.google.com/presentation/d/1NYS3DfTDV7_KRnh8gSCvqGVUPPNE6aje/edit?usp=sharing&ouid=110820941423954766874&rtpof=true&sd=true

- **Cards for activity 2**-print size letter-: https://docs.google.com/presentation/d/1UFk7qzcDfcF1pKAYw9xy6X5im5imd95a/edit?usp=sharing&ouid=110820941423954766874&rtpof=true&sd=true

- **Formats for activities 3,4** -print size letter-: https://docs.google.com/presentation/d/1DGi5cSGnAyRrXhtu6x8OoPWpGQwBG-QF/edit?usp=sharing&ouid=110820941423954766874&rtpof=true&sd=true

Module 5

Session : Brief Summary
- **Cuervo, F., Restrepo D., Maya L. (2025). Luminis Harmonia: Targeted Strategies for Sustainable VET Lighting Practices**
Overview: This research report on light pollution presents and overview of the light pollution and country specific analysis of Germany, Estonia, Croatia and Colombia
https://drive.google.com/file/d/1vAiOsBvgWVploelgYbZAugIXUifXqEBB/view?usp=share_link
- **Royal Society of New Zealand (2018). Impacts of artificial blue light on health and environment**Overview: This evidence summary presents an outline of the artificial sources containing blue light, their impact on human health and the environment and some actions to reduce the harmful effects of blue light on the night sky.https://www.royalsociety.org.nz/assets/Uploads/Blue-light-Aotearoa-evidence-summary.pdf

Session: Communication Campaigns
- **ARUP (2015). Cities Alive: Rethinking the shades of night**
Overview: "This report explores the future of cities at night, and the role lighting solutions can play in enabling healthy, inclusive and sustainable urban lifestyles. It emphasizes a more context-sensitive design approach and a holistic integration of lighting infrastructure into the urban fabric."https://www.arup.com/insights/cities-alive-rethinking-the-shades-of-night/
- **Kolovea, K. (2020). The lighting police**
Overview: Community initiative which aims to " shed light on the importance of proper lighting in our lives". This website gathers videos and images as educational material about light pollution and related topics.
https://thelightingpolice.org/about-tlp/

Session: Governances and roles
- **Nighttime.org (2023) Nighttime Advocacy Map**

Overview: This website gathers the diverse offices or leaders in charge of the nighttime governance around the world. Through the map the diverse ways of governance are divided in two categories: (a) office within city government and (2) non-governmental group.
https://www.nighttime.org/map/

- **Posh. (2024) NYC's First Mayor of Nightlife, Ariel Palitz**

Overview: In this video (38:37 minutes) Ariel Palitz, first Mayor of Nightlife of NYC explains the path which led her to gain this title, the main challenges she has faced in this role and the principal insights and lessons learned articulating diverse stakeholders of the nighttime
https://www.youtube.com/watch?v=F8U14b7-krs

- **Reia, J. (2023) Amsterdam was the first city in the world to hire a 'Night Mayor'—now the practice is catching on as cities look for help governing after dark**

Overview: This article explores the emergence of the title of night mayors to lead the governance of the nighttime in the cities and the main challenges leaders face to articulate the nighttime ecosystem
https://fortune.com/2023/05/30/night-mayors-24-hour-cities-nocturnal-governance-rising/

- **Seijas, A (2016). 4 razones por las que Cali ahora tiene un Gerente de la Noche**

Overview: Even though this blog has been around 9 years the content shows the evidence of the efforts made in Cali to manage the urban night. This blog presents why this role was designated, explains the main responsibilities of the role and first actions.
https://blogs.iadb.org/ciudades-sostenibles/es/cali-2/

- **Seijas, A., Zebrowski, M. (2025). Who owns the night? A deep dive into Nocturnal Cities**

Overview: This interview with Andreina Seijas an expert in nighttime urban governance explores the multidimensional field of the night, the evolution of nighttime governance and the common challenges of solutions in planning this time of the day.
https://www.urbcast.pl/blog/nocturnalcities

○ **Villalobos, P. (2022). Noche Zero 10 years Embracing the Darkness & Design for the Night**

Overview: This video (27:20 minutes) explains the initiative called Noche Zero. First Paulina Villalobos introduces the central challenge related to light pollution and the current situation of this challenge. Then presents some actions and key points to bear in mind to do appropriate lighting design proposals.

https://www.youtube.com/watch?v=Po9mRZzjjck

Session: Create an assertive pitch

• **Ganz, M. Public Narrative Participant Guide**

Overview: This guide shows the step by step of the Public Narrative practice. First introduces what is and the key aspects of Public Narrative, then explains each one of the three components, story of self, story of us and story of now. Finally, propose some worksheets to practice.

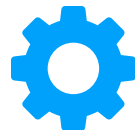https://www.ndi.org/sites/default/files/Public%20Narrative%20Participant%20Guide.pdf

Session 1 | Brief Summary

DURATION:
1 hour

MATERIALS:
- Slide presentation for Session 1
- Computer and projector with internet access
- Printed or digital images of the four main typologies of light pollution (preferably with local examples)
- Whiteboard or flipchart and markers (optional)
- Notebooks or digital devices for notetaking

EVALUATION METHODS:
- **Participation in Review Activities:** The facilitator will assess participants' active engagement during the session, particularly their contributions when recalling and connecting key concepts from previous modules (light pollution, impacts, diagnosis, and solutions).
- **Concept Integration:** Evaluation will focus on the participant's ability to relate the main ideas of environmental, technical, and governance aspects of light pollution, showing a holistic understanding of the topic.

👥 GUIDED LEARNING (45 MINUTES)

Step 1: Welcome and Icebreaker (15 min)

Activity: *"Light Pollution Summary"*

1. Introduce the module "Community Action and Multi-Level Governance" with the topics that will be addressed during the session
2. For the icebreaker, ask participants to present themselves with their name, their role (student, decision maker, community leader, etc) and to describe light pollution in one word.
3. The facilitator links these words to the overview of light pollution.

Step 2: Summary of light pollution (30 min)

Activity: *" Basic concepts learned in previous modules"*

1. Explain that the main purpose of urban lighting is to revitalize public meeting spaces such as parks and squares, and because of this light should be properly placed where it is needed.
2. Relate the purpose of urban lighting to the definition of light pollution and reflect on the fact that the main cause of light pollution happens when light is incorrectly placed where it is not needed.
3. Present the four main typologies of light pollution (sky glow, glare, trespass & blue light pectrum) and reflect about some places in your city or town where you can see some examples of these situations. Emphasize that although the blue light spectrum is not always the most visually evident, it does have a significant impact on the behavior and physiology of various organisms.
4. Explain the four main effects of light pollution and deliberate about the most common effects in your city or town.

Note: Before the session, the facilitator can choose some pictures of the four main typologies of light pollution and introduce them to the presentation to include local examples more relatable to participants.

👥 WORK-BASED LEARNING (15 MINUTES)

- **Methodology:** Questions and answers.

After presenting the slides with a summary of light pollution, the facilitator asks if there are any questions about the definition, typologies and main effects of light pollution. The facilitator can use some of these questions:
- Do you think there are other typologies or effects of light pollution?
- Are you clear about the basic concepts of light pollution?
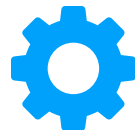- Can you give us some examples of light pollution in your city or town?

Session 2 | Communication Campaigns

DURATION:
1 hour 30 minutes

MATERIALS:
- Slide presentation for Session 1.
- Computer and projector with internet access.

Access to external platforms and materials:
- The Lighting Police
- Cities Alive – ARUP Report
- The Lighting Police Instagram

- Printable format for communication campaign activity (70cm x 50cm):
- Markers, colored pencils or drawing materials for campaign design
- Paper or digital tools for campaign drafting and presentation.

EVALUATION METHODS:

- **Participation and Collaboration:**

The facilitator will assess each participant's involvement in group discussions and teamwork during the design of the communication campaign.

- **Creativity and Relevance:**

Evaluation will focus on how effectively the campaign conveys its message about light pollution, using clear, accessible language and appropriate communication channels (e.g., posters, social media, public talks).

- **Clarity of Message:**

The facilitator will consider how well the campaign identifies its audience, defines its key message, and proposes realistic actions to promote awareness or behavior change.

👥 GUIDED LEARNING (45 MINUTES)

Step 1: Explanation about communication campaigns (10 min)

Activity: *"Concepts and Key points"*

1. Introduce the chapter explaining the meaning of the concept "plain language" and emphasize that this is a crucial point to connect with other people's interests and act together. Highlight the relevance of translating the technical concept of light pollution into simple and relatable definitions

2. Present the five key points (Define the purpose, Set the message, Establish the target group, Choose the communication channel, Determine the call to the action) to structure a communication campaign reflecting on the questions presented in the slide (12) presentation. Then explain that the plain language must be integrated in all the processes of the communication campaigns and that the main goal of these campaigns is making a memorable narrative. For this, putting people in situations through photos, graphics or everyday situations can be essential.

Note: Before the session it is recommended that the educator and participants explore some communication campaigns related to light pollution they find interesting and bring those examples as inspiration for the work-based learning time.
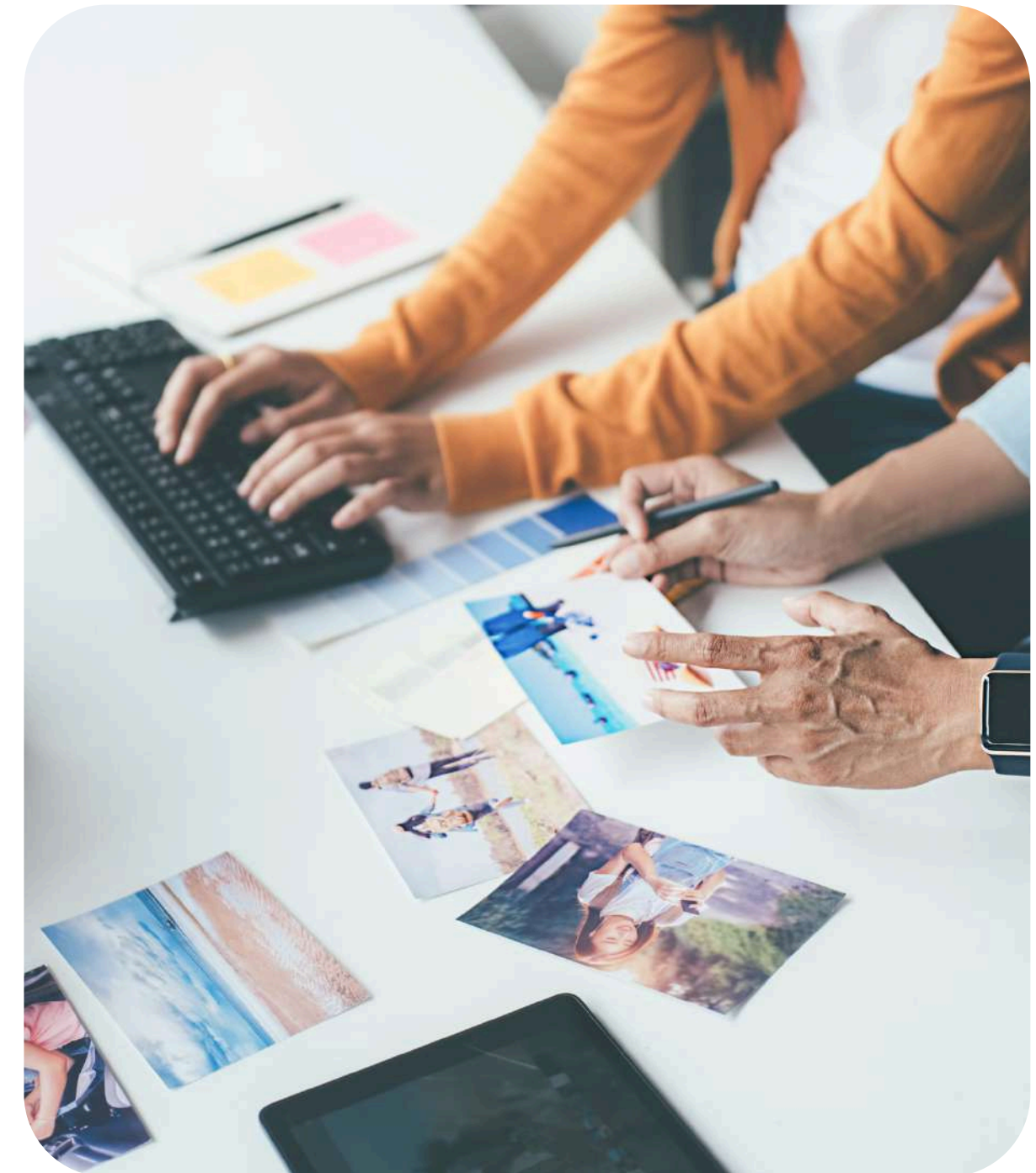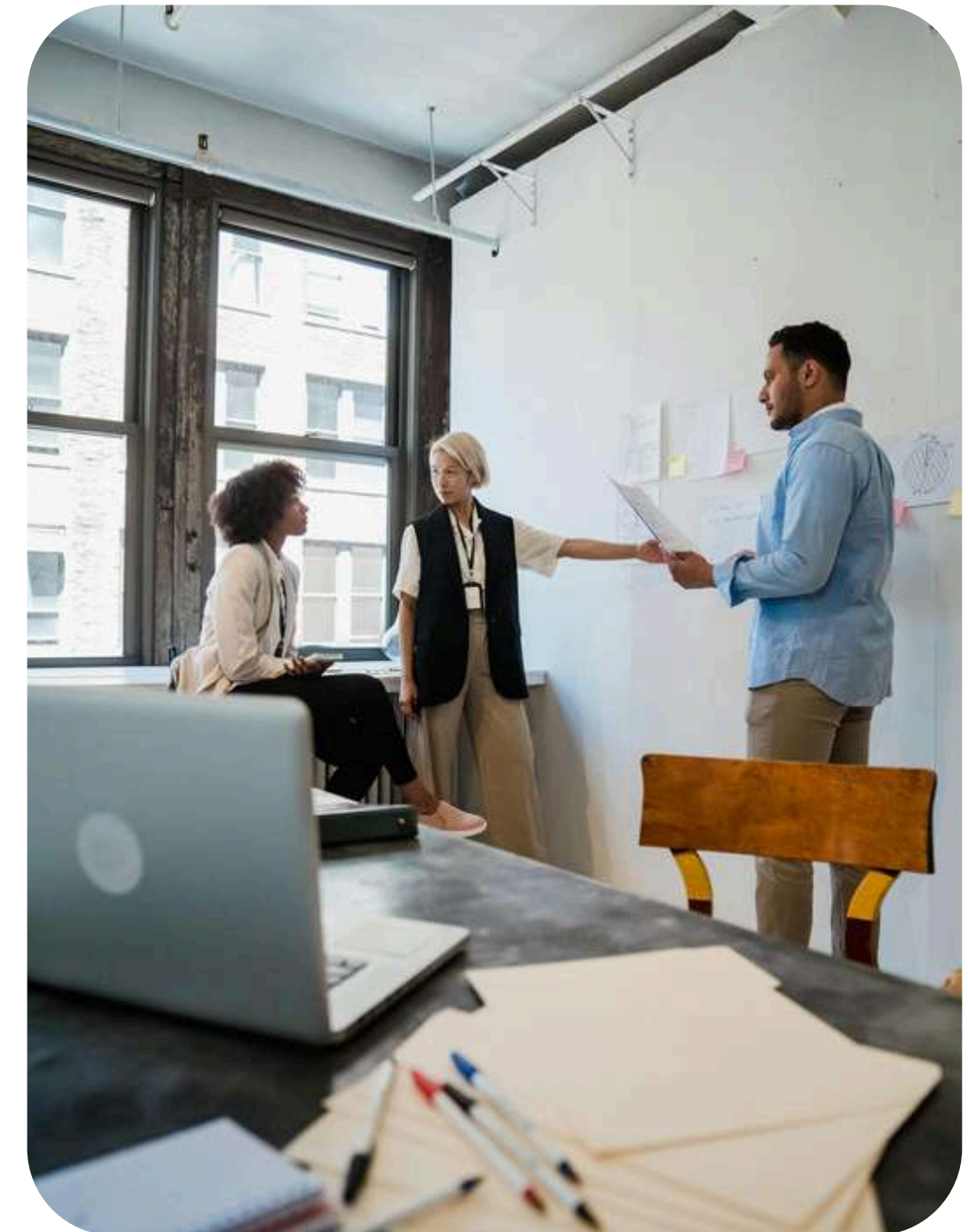
Step 2: Examples of communication campaigns (35 min)

Activity: *"Collaborative platform"*

1. Present the first example "The Lighting Police". Emphasize how this collaborative platform has been growing organically, first as a virtual place to connect people with the same interest and awareness about light pollution, and now how this platform has evolved into an organization who promotes educational activities through events and collective meetings.

2. Enter to The Lighting Police Instagram profile and explore the pictures of your country in the highlight stories or in case your country is not there, choose a place with a relatable context. Bring out the way this platform creates a space where everyone can share their experiences or concerns and act together to raise awareness about light pollution. Link

3. Explain two cases of communication campaigns on this platform. The first one "**Say it with light challenge**" is a global challenge in which participants could select a landmark and draw a sketch of a lighting proposal to use light as a messenger and put light in the correct place.

4. The second case is a section called "**TLP Lighting Tips**" where trough simple sketches the lighting police explains lighting pollution concepts showing the incorrect way to do it and the proper way to do it. Highlight the simplicity of the graphics which allow people to understand technical concepts in a quick and clear way.

Activity: *"Expertise knowledge"*
1. Present the second example "ARUP". Highlight how a consulting firm makes available the technical knowledge resulting from years of experience in infrastructure design and construction, at the service of anyone through workshops and reports with free access.
2. Play the video of a night-time lighting design workshop (58 seconds). Emphasize the way ARUP teaches light vocabulary through a "learning by doing" workshop and also remark how ARUP makes available the overview of the workshop to the general public through short videos with a clear narrative.
3. Show the "Cities Alive: Rethinking the shades of Night" report and explain how ARUP mix technical information with simple graphics so according to the level of knowledge of the person who is reading the report, he or she can go deep into the reading or just focus on the explanation graphics to understand the main concepts. This approach allows diverse people from basic to advanced knowledge in the topic access to technical information.

Activity: *"Short memorable stories"*
1. Present the third example "Noctua". Emphasize how Noctua achieves that anyone who accesses their website, besides being able to explore their professional services, can understand the relevance of lighting design through a short story.
2. Read aloud the three slides with the short story about the night and analyze how through the images Noctua manages to communicate the importance of placing lighting in the appropriate place to prevent disturbing nature and the surrounding ecosystem.
3. Emphasize the short sentences with plain languages and the clear and telling images which allow people to understand the story and the main message.

Activity: "Summarize"

1. *Present the key points of the three examples and make evident that no matter the role a person or organization has, there are many ways to raise awareness about light pollution*

2. *Ask participants if they have any questions about the examples or if they want to share other learnings from the examples.*

👥 WORK-BASED LEARNING (45 MINUTES)

Activity: Communication Campaign format

1. After presenting the slides about how to structure a communication campaign and the examples, invite participants to create their own communication campaign. According to the size of the group ideally people can work in teams from 3 to 5. If the group is very small people can work individually.

2. Present the structure of the format:

3. The left section of the format is for structuring the communication campaign proposal, for which the five key points are listed. Each person or team has to fill each one of the key points. (15 minutes)

4. In the right section of the format people have to include their communication campaign proposal. They can draw and/or write it (15 minutes)

Finally, each team or person has 2 to 3 minutes to share their communication campaign proposal (the time available can be adjusted according to the number of participants). Ensure the time to give feedback to each group about their proposal both from educator and other participants. Finish the activity with debriefing using all or some of the following questions (depending on the time available):

- What was your team's objective and target audience, in one sentence?
- Which of the five key points was easiest to complete? Which was most challenging?
- What choices did you make in the right-hand "proposal" section (message, channel, visuals), and why?
- How did time constraints affect your decisions or scope?
- What feedback did you receive from peers/educator? What stood out?
- How did your team collaborate and make decisions? What roles emerged naturally?
- Where did you feel most confident, and where did uncertainty show up?
- What assumptions about your audience or channels did you notice as you worked?
- Looking at others' proposals, what caught your attention or surprised you?
- If working individually: What was different about working solo compared to how you usually plan communications?
- Which elements are critical for a clear, persuasive campaign proposal, and why?
- How did the five key points help or constrain your thinking? Would you add or change any?
- What criteria now seem most useful to evaluate a campaign (e.g., audience insight, single-minded message, channel–message fit, behavioral objective, metrics)?
- What patterns did you notice across strong proposals (e.g., clarity of problem, sharp targeting, feasible channels, consistent tone)?
- How does this exercise connect to the frameworks/examples presented earlier? What principles were validated—or challenged?.

- If you had 15 more minutes, what would you refine first and how?
- What is one specific test or metric you would run in the first week of launching this campaign?
- What will you do differently in your next real campaign brief or presentation?

Note: During the work-based learning the instructor will go through each of the groups guiding the process and reminding participants of the remaining time to achieve the exercise objective. The format was designed to be printed in a size of 70 centimeters wide x 50 centimeters long.

Session 3 | Governances and roles

DURATION:
1 hour 30 minutes

MATERIALS:
- Slide presentation for Session 2.
- Computer and projector with internet access

Access to external resources:
- Nighttime Advocacy Map
- OPCC website
- Global Nighttime Recovery Plan
- Global Nighttime Manifesto (PDF)
- Noche Zero video

- Printable role cards for the roleplay activity (letter size): Role cards link
- Printable roleplay format (70cm x 50cm): Group format link

EVALUATION METHODS:

- **Role Mapping Exercise:**

Evaluation will focus on how accurately and logically participants assign responsibilities and interactions among stakeholders. Clarity of reasoning and collaboration within groups will be key indicators.

- **Application to Real Contexts:**

Participants will be asked to briefly describe how similar governance structures could work in their own city or institution. The facilitator will evaluate the relevance and feasibility of these reflections.

👥 GUIDED LEARNING (45 MINUTES)

Step 1: Explanation about nighttime governance (10 min)

Activity: *"Concept and roles"*

1. Introduce the chapter explaining meaning of governance in the nighttime and the relevance of connecting diverse sectors to work together towards a common goal
2. Present the five main roles for the nighttime advocacy and give some examples of people, groups or associations related to these roles as is included in the slide. Emphasize that to achieve the concept of governance the collective action of these five roles or sectors is essential.
3. Explain the emergence of the title of night mayors around the world and how the principal aim of this role is to articulate the approach to nighttime governance among diverse stakeholders.
4. Explore with the participants the "Nighttime Advocacy Map" created by **nighttime.org** Highlight that leading the nighttime governance not necessarily has to come from the central government (cyan marks) in some cases are non-governmental institutions or associations who take the lead of the governance (blue marks). Clarify that this map gathers current and past governance offices and leaders, in some cases those offices or roles no longer exist. However, it is important to see that significant efforts have been made in different countries to govern from an articulated vision at nighttime. https://www.nighttime.org/map/
5. Search for the specific country in the map according to the location where you are, in some cases as Croatia, there is not an institution mapped, so you can explore the direct context with some examples in near locations. The same happens to Chile, but instead of including a map of the context, there is an example of the OPCC explained in the next activity for all participants regardless of their location.

Note: Before the session it is recommended that the instructor explore some examples of each one of the five roles in the country or city and present them during the explanation of that slide so participants can understand these roles in a more relatable way.

Step 2: Examples of night governance (35 min)

Activity: *"Protection of the night sky"*

1. Present the first example "Office of Protection of the Quality of the Sky of Northern Chile -OPCC-". Emphasizes how this office was created to support the implementation of the Emission Standard for the Regulation of Light Pollution. https://www.opcc.cl/nuestra_historia.html

2. Explain that even though the main aim of the OPCC is to support the implementation of the regulation, this office is additionally educated, helps to do correct oversight and also makes resources available to people about the prevention and awareness of light pollution. All these actions have the same goal in mind, the protection of the night sky in Chile.

Activity: *"Study cases and lessons learned"*

1. Present the second example "The Global Nighttime Recovery Plan". Highlight how a global network of nighttime advocates, scientists and institutions from the public and private sector worked together to create these reports to support other countries and cities through study cases and lessons learned around the world https://vibe-lab.org/global-nighttime-recovery-plan

2. Explain how around a common challenge -as COVID was- a strong network was created to share experiences and case studies through collaborative work which made it possible to replicate solutions in diverse contexts faced with similar problems. And, in some cases when there is not a visible leader, diverse sectors can come together to share their knowledge to support and face the nighttime challenges together. In this case, experts in diverse topics led each one of the different reports and connected diverse sectors.

Activity: *"Simple but high impact actions"*

1. Present the third example "Global Nighttime Manifest". This is a simple tool that can be used to start conversations across diverse sectors and roles to convey a common goal. The first step is to recognize who is involved in the challenge and establish a common purpose.
2. Explain how this manifest is structured with simple paragraphs which make very clear the "why" of the purpose and the call to action. This is an instrument that can be easily shared and could be the starting point to put a specific topic on the table to be discussed
   https://www.nighttime.org/wp-content/uploads/2022/09/Rise-Up-A-Manifesto-for-Nightlife.pdf

Activity: *"Initiatives led by experts in the topic"*

1. Present the fourth example "Noche Zero by Paulina Villalobos". This initiative raises the question about how to balance the need of a regulation for the protection of the dark skies and the lighting design quality of urban life from an innovative approach.
2. Explain how currently most lighting proposals are regulated having the use of the car in the center of the discussion and how this situation has to be changed to a broader discussion approach from a human and ecosystem perspective linked to aspects such as health, nature and heritage.
3. Emphasize how this initiative created the Atacama Manifesto gathering people from diverse backgrounds such as science, design and culture to talk about light pollution and promote the discussion about the use of the right amount of light.

Activity: *"Summarize"*

1. Present the key points of the four examples and make evident that no matter what the role or the extension of it, there are many ways to gather and work together towards the governance of the nighttime to prevent the light pollution in our countries.
2. Ask participants if they have any questions about the examples or if they want to share other learnings from the examples.

👥 **WORK-BASED LEARNING (45 MINUTES)**

Activity: Roleplay exercise.
- After presenting the diverse roles and approaches to night governance, invite participants to build their own governance team. According to the size of the group, ideally people can work in teams from 3 to 5. Use group division exercises listed in Module 2 for this.

Present the step by step of the exercise:
- Each member of the team selects a card with an aleatory role. There are five cards with different roles: night mayor, leader in an astronomy agency, lighting designer, social foundation member and community leader. Each person will analyze their role reading the description, challenge and superpower of their role (5 minutes)
- Then each group works with a Roleplay format: (25 minutes)
- First, the group defines a common goal to work towards light pollution prevention or awareness
- Secondly, each member of the team, according to their role, writes how he or she can contribute to achieving the common goal
- Thirdly each team writes the main agreements they reached.

👥 WORK-BASED LEARNING (45 MINUTES)

(Alternatively, if applicable, participants can create a short performance where they could act out the role play.)

- Finally, each team has 2 to 3 minutes to share their main discussions and agreements, this time can be adjusted according to the number of participants. Participants will receive feedback about their discussions and agreements and the instructor will close the chapter with the main insights and lessons learned of the exercise. You can use the debriefing questions available in previous session, adapting it to suit this activity for the wrap up step.

Note: During the work-based learning the instructor will go through each one of the groups guiding the process and reminding participants of the remaining time to achieve the exercise objective. The group format was designed to be printed in a size of 70 centimeters wide x 50 centimeters long and the role cards are in letter size.
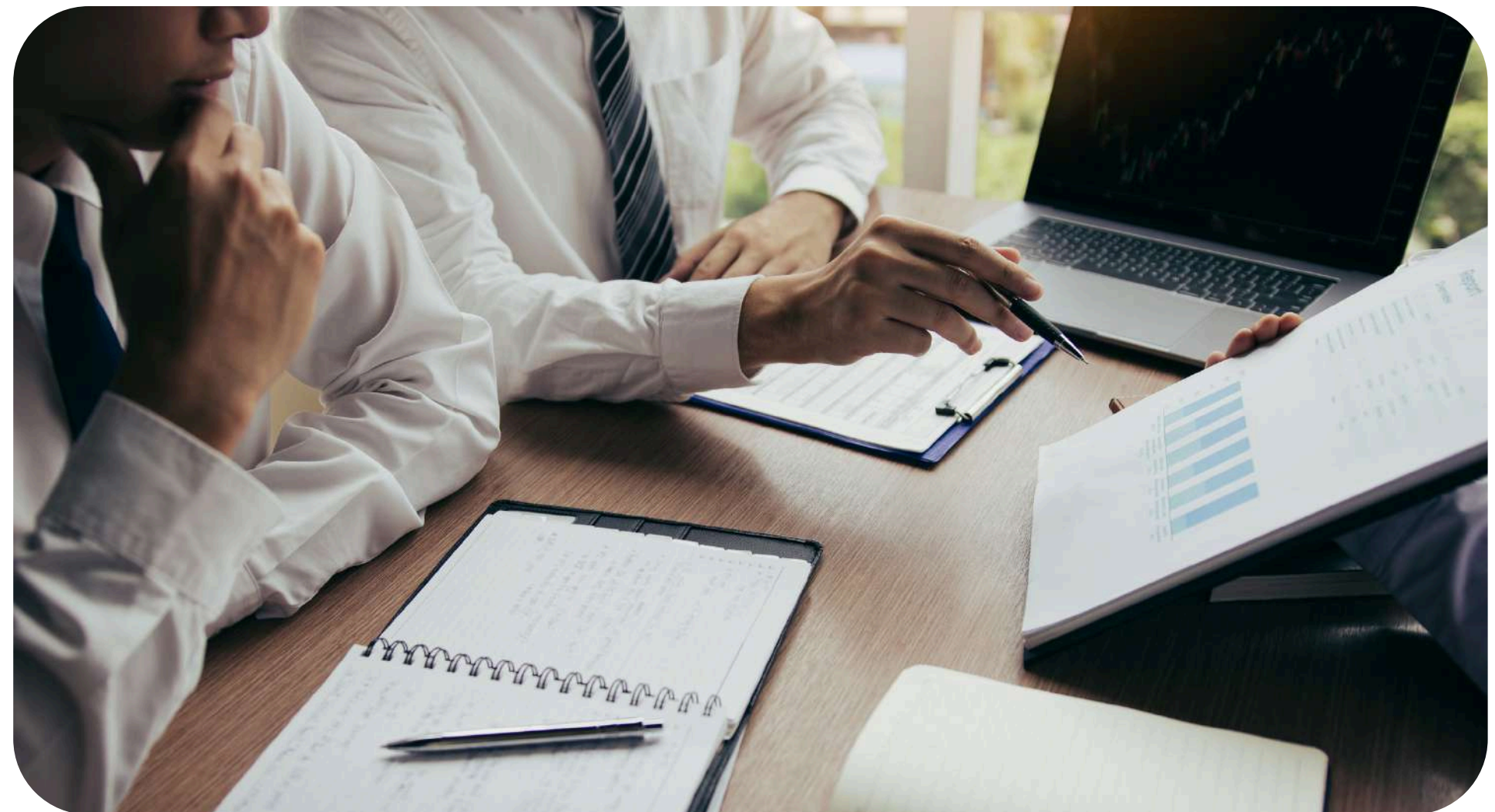
DURATION:

1 hour 30 minutes

MATERIALS:

- Slide presentation for Session 3
- Computer and projector with internet access

Access to external resources:
- Chile's Regulation
- Lighting Competition Overview

- Printable proposal format (70cm x 50cm) and instrument sheets (letter size): Proposal format link
- Writing/drawing materials for participants

EVALUATION METHODS:

- **Structure and Coherence of the Proposal:**

Evaluation will focus on how clearly participants define the problem, objectives, proposed actions, and expected outcomes. Logical flow and internal consistency will be key indicators.

- **Feasibility and Relevance:**

The facilitator will observe whether the proposed ideas are realistic, context-appropriate, and aligned with sustainable lighting principles and community needs.

👥 GUIDED LEARNING (45 MINUTES)

Step 1: Welcome back and Icebreaker (10 min)

Activity: "Afternoon session"

1. Start with a quick icebreaker. Ask participants to describe their current mood with one word. According to the answers, set the mood for the session.
2. Introducing the afternoon session with the topics that will be addressed.

Step 2: Explanation about how to structure a Light Pollution Prevention proposal. (10 min)

Activity: "Key points"

1. Introduce the chapter explaining the key points to structure a proposal. Explain that these are the general aspects, however according to the instrument selected, people have to establish other particularities which are going to be explored through the examples in the next slides.
2. Go through each one of the six key points to structure a proposal explaining the questions which need to be answered and the activities which must be done.
3. Finally, emphasize the need to document and divulgate the process, results and lessons learned. As participants explored during the previous chapters, these actions allow people from other contexts to learn about and implement similar strategies. Also, through divulgation other organizations or people could know and join the cause.

Step 3: Examples of instruments (25 min)

Activity: *"Structure of a regulation"*

1. Present the first example "Chile's regulation – Emission Standard for Artificial Light Generated by Outdoor Lighting". Emphasizes that Chile has one of the most comprehensive and structured regulations on light pollution.

2. Present Chile's regulation through how this was structured. Go through each one of the eight main points of the regulation describing how each point was addressed through regulation. For more details you can explore their website https://www.opcc.cl/revision_ds043.html

3. For the case of the other countries, the instructor can give an overview of the regulation context in each one of them using the slides that apply.

Note: Before the session it is recommended that the instructor reads the section called "Local Government Policies and Regulations" of the research report: Cuervo, F., Restrepo D., Maya L. (2025). Luminis Harmonia: Targeted Strategies for Sustainable VET Lighting Practices

https://drive.google.com/file/d/1vAiOsBvgWVploelgYbZAuglXUifXqEBB/view?usp=share_link

Activity: *"Open competitions"*
1. Present the second example "VI Lighting Standard Competition: The skies are part of our identity". Led by the OPCC - mentioned in the previous chapter - together with aura, noir lab and the Ministry of the Environment of the Coquimbo Region. This is a great example of how to raise awareness and educate about light pollution at a local scale.
2. Explain the components which structure a competition and describe how these components are filled with Coquimbo Region's Competition example.

Activity: *"Lighting project"*
1. Present the third example "Collective Light for Rural Africa" whose purpose was to "Introduce off-grid lighting to rural areas of Mali by developing an appropriate technology inspired by local culture to enhance social and economic context."
2. Explain how the essence of this project was to understand the purpose of introducing lighting in the territory resulting in a well-structured lighting element which prevents light pollution by putting the light in the right place and in the right direction.
3. Show how this element was easily transported by community members to place the light where it was needed. Highlight the governance of the "lantern" considering that "Each association elected a committee to manage the lanterns and schedule their allocation within the community."
4. Finally, present the components to structure a project and how the "Collective light for Rural Africa" project approaches each component.

Activity: *"Summarize"*
1. Present the key points of the three examples and make evident the diverse instruments available to stop and prevent light pollution in our countries.
2. Ask participants if they have any questions about the examples or if they want to share other learnings from the examples.

👥 WORK-BASED LEARNING (45 MINUTES)

Methodology: structure a proposal format

- \- After presenting the slides about how to structure a proposal and the examples, invite participants to create their own proposal. According to the size of the group ideally people can work in teams from 3 to 5. If the group is very small people can work individually. If you decide to split participants into small groups use group division exercises available in Module 2.
- Explain how to use the "Structure a Proposal" format:
  - Introduce the purpose of the tool:Explain that this format guides participants through the six key steps for structuring a proposal related to *light pollution prevention or governance*. Emphasize that it is a flexible tool — they can adapt it to a project, regulation, campaign, or pilot initiative.
  - The left section - Structuring the proposal (15 minutes) Participants must complete each of the six key points listed on the left side of the format:
    - Define the purpose
    - Select the instrument and set the timeline
    - Establish the baseline
    - Identify stakeholders
    - Create oversight mechanisms
    - Evaluate the proposal
    - Encourage participants to discuss and agree as a team before filling each box.

- ○ Right section – Detailing the instrument (15 minutes).On the right side, participants should choose one instrument (e.g., regulation, competition, or project) and include the specific components needed to structure that type of instrument. They can use the examples presented in the previous slides as guidance.The complementary instrument formats are letter-size sheets and can be attached to the main format.
- Finally, each team or person has 2 to 3 minutes to share their proposal, this time can be adjusted according to the number of participants. During the presentations provide feedback to participants, and invite the rest of the group to share their feedback as well. Close the session with debriefing using some or all of the following questions (according to the time you have): What was your team's objective and target audience, in one sentence?
- Which of the six key points was easiest to complete? Which was most challenging?
- What choices did you make in the right-hand "proposal" section and why?
- How did your team collaborate and make decisions? What roles emerged naturally?
- Where did you feel most confident, and where did uncertainty show up?
- Looking at others' proposals, what caught your attention or surprised you?
- Which elements are critical for a clear proposal, and why?
- How did the six key points help or constrain your thinking? Would you add or change any?
- How does this exercise connect to the frameworks/examples presented earlier? What principles were validated—or challenged?
- If you had 15 more minutes, what would you refine first and how?

Note: During the work-based learning the instructor will go through each of the groups guiding the process and reminding participants of the remaining time to achieve the exercise objective. The main format was designed to be printed in a size of 70 centimeters wide x 50 centimeters long. The instrument's format was designed to be printed in a letter size.

DURATION:

1 hour 30 minutes

MATERIALS:

- Slide presentation for Session 4.
- Computer and projector with internet access.

Access to:

- Public Narrative Participant Guide[PDF Link](PDF Link)

- Printable pitch format (letter size)
- Notebooks or digital devices for drafting narratives

EVALUATION METHODS:

- **Observation & Participation:**

The facilitator observes participants' engagement and understanding during the explanation and practice of the Public Narrative exercise.

- **Pitch Delivery:**

Participants' 2–3 minute pitches are assessed based on clarity, structure (Story of Self, Us, Now), confidence, and emotional connection.

- **Peer & Instructor Feedback:**

Both facilitator and peers provide short, constructive feedback after each presentation.

- **Reflection:**

A short group debrief helps participants reflect on what they learned about themselves, others, and the importance of collective storytelling.

👥 GUIDED LEARNING (45 MINUTES)

Step 1: Explanation about an assertive pitch

Activity: *"Public Narrative"*

1. Introduce the chapter explaining the relevance to work collectively and connect with other people's interest to create an impact in the awareness and prevention of light pollution.
2. Present the Public Narrative practice. This practice developed by professor Marshall Ganz is "an exercise of leadership aimed towards motivating other people to join you in action on behalf of a shared purpose".
3. Explain that the Public Narrative was conceived as a process to highlight the power of story. For this, connects three stories:
   - Story of self: This encourages people to ask themselves why are you called to take leadership? and/or, What is that personal experience that led you to be involved in this cause?
   - Story of us: This invites people to think about what is that shared goal which connects us. What is that common purpose towards which we can act together? This includes shared values and shared experiences
   - Story of now: This inspire people to act now and be able to identify the urgency to act
4. Emphasize that the goal of this practice is to connect the three stories and be able to communicate how a specific situation affects us, what we can do to change it and why to act now.
5. Ask participants if they have any questions about this practice

Note: Before the session it is recommended that the instructor reads the "Public Narrative Participant Guide" to understand this practice

https://www.ndi.org/sites/default/files/Public%20Narrative%20Participant%20Guide.pdf

👥 WORK-BASED LEARNING (45 MINUTES)

Activity: Public narrative format

1. After presenting the public narrative practice invite participants to structure their own pitch. Preferably this exercise should be developed individually.
2. Each person has 10 minutes to fill each one of the three stories: story of self, story of us and story of now. To write each story there are the following guiding questions: (30 minutes)
   - **Story of Self – "Why am I called to act?".** Focus: Personal motivation and values.
   - **Story of Us – "Why should we care together?".** Focus: Shared values and collective identity.
   - **Story of Now – "Why must we act now?".** Focus: Urgency and call to action.
3. After they finish the task, each person has 2 to 3 minutes to share their speech. In case the group is too big some people can be selected to present. During the presentations provide feedback to participants, and invite the rest of the group to share their feedback as well. Close the session with debriefing using some or all of the following questions (according to the time you have):

Was it difficult to create your own story? If yes, why?: What did you learn about yourself during this exercise? What did you learn about others?; Did you notice any similarities between the stories?; How can we use those similarities for our cause?; How did you like the exercise? Please share your experience in few words.

- Finally, thank people for being part of this learning journey.

Note: During the work-based learning the instructor will go through each one of the groups guiding the process and reminding participants of the remaining time to achieve the exercise objective. The pitch format was designed to be printed in a letter size.

Methodological Instructions

The methodological framework of the curriculum for obtaining the qualification "Specialist in Light Pollution Mitigation – EcoLume" is designed to ensure an engaging, inclusive, and effective teaching and learning process aligned with the principles of adult education (andragogy) and the European standards of vocational education and training (VET).Since the target group primarily consists of adults – youth workers, educators, technicians, and professionals – the methodology emphasizes relevance, experiential learning, and the practical application of acquired knowledge.

Creating the Learning Environment

At the beginning of the program, facilitators should establish a welcoming and respectful atmosphere, highlighting the importance of mutual trust and collaboration.

Adult learners are more engaged when they understand the purpose and expected outcomes of their learning, so clear communication of objectives and competencies is essential.

Trainers should also collect participants' expectations, prior knowledge, and personal experiences related to artificial light and sustainability, and use them to shape the learning process.

Teaching and Learning Approach

The curriculum combines guided learning, work-based practice, and independent study. Each module is built around real-world scenarios connected to light pollution—urban lighting, health effects, biodiversity protection—allowing participants to see the direct relevance of their learning.

Interactive methods such as debates, simulations, role-play (e.g., a "light pollution tribunal"), and collaborative projects are strongly encouraged.

Participants are not passive recipients of knowledge but active co-creators of the learning process. Their prior professional and personal experiences should be systematically integrated through reflective discussions, peer-to-peer exchange, and case studies drawn from their own environments.

Practical and Competence-Based Focus

Following the European Qualifications Framework (EQF), the program stresses competence development:

- Knowledge of ecological, technological, and social aspects of light pollution.
- Skills to measure, analyze, and design solutions for sustainable lighting.
- Attitudes of responsibility, critical thinking, and advocacy for environmental sustainability.

Practical activities—such as measuring skyglow, auditing lighting in public spaces, or designing awareness campaigns—are central. These hands-on experiences transform abstract concepts into actionable competences.

Inclusivity and Support

Given the diversity of adult learners, trainers should account for different learning paces, backgrounds, and levels of digital literacy.

Instruction must remain inclusive, supportive, and adaptable, ensuring that learners feel respected and empowered rather than judged.

Special emphasis should be placed on accessibility, intercultural sensitivity, and sustainability values.

Structuring the Sessions

Facilitators are encouraged to:

- Begin with icebreakers and self-introductions that connect personal experiences to the topic of light pollution.
- Define and communicate clear objectives and rules of collaboration (respect, listening, constructive feedback).
- Provide step-by-step guidance for independent tasks and explain assessment methods transparently.
- Use formative evaluation (quizzes, group reflections, peer feedback) throughout the modules, ensuring continuous learning support.
- Close each session with a reflection activity, allowing participants to connect new knowledge with their professional and personal lives.
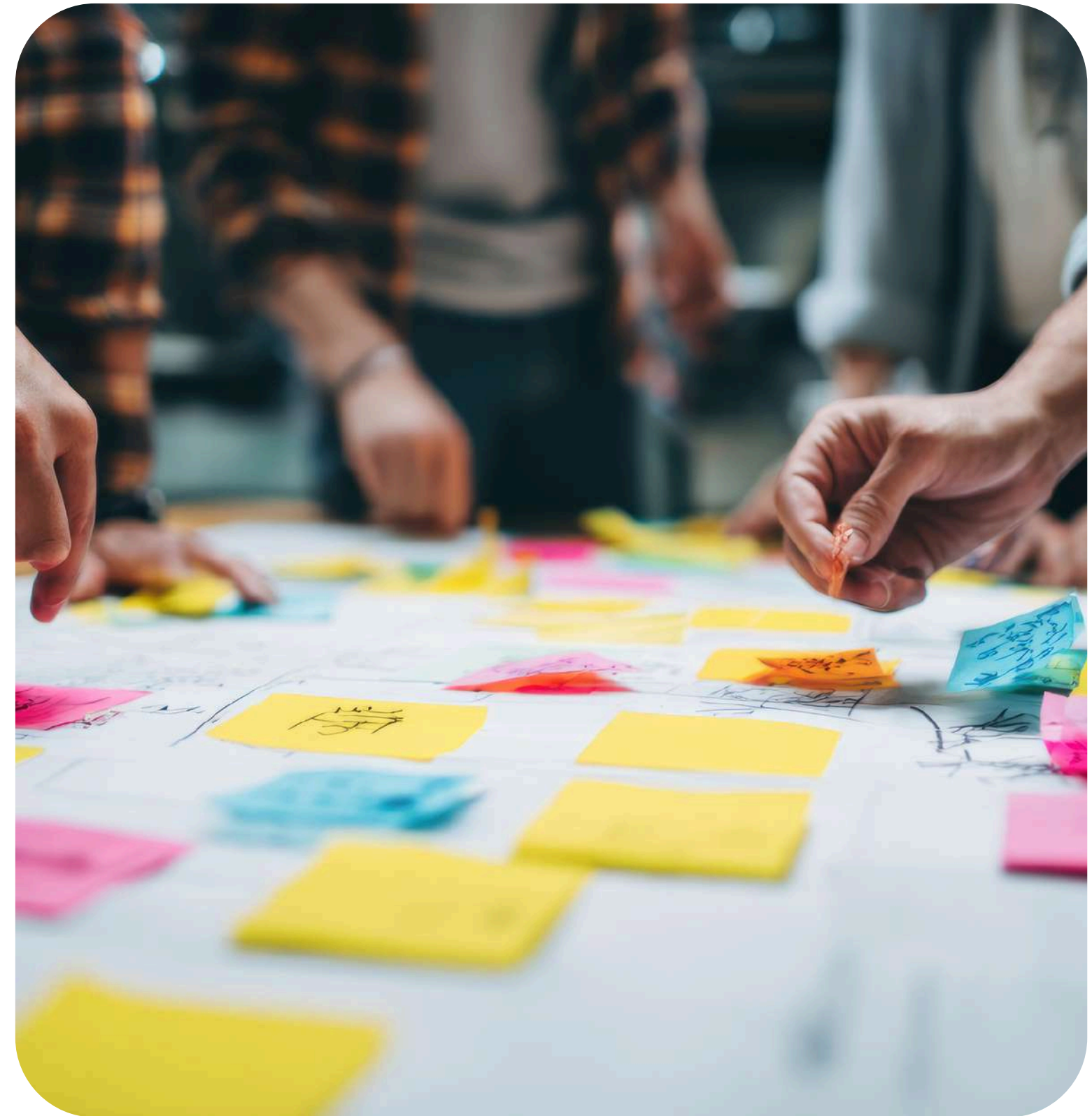
Role of the Educator

The educator acts primarily as a facilitator and guide, not merely a transmitter of information.

Their role is to encourage self-directed learning, create opportunities for knowledge exchange, and provide constructive feedback.

By balancing professionalism with empathy and flexibility, educators help transform the curriculum into a transformative learning journey.

Recommended methods of monitoring the quality and success of program implementation

Monitoring and evaluation are key components of the curriculum for obtaining the qualification "Specialist in Light Pollution Mitigation", as they ensure that the program remains relevant, effective, and aligned with European standards of vocational education and training (VET). The evaluation methods focus on both the quality of program implementation and its impact on participants, using a combination of quantitative and qualitative approaches.

Participant Feedback
- **Anonymous surveys** at the end of each module should collect learners' opinions on the relevance of the content, clarity of teaching, quality of resources, and usefulness of practical activities.
- **Reflection journals** and short self-assessment forms should be used to capture participants' learning experiences, personal progress, and confidence in applying competences.
- **Focus group discussions** can provide deeper insights into how learners perceive the program and where improvements may be needed.

Educator and Trainer Feedback
- Trainers should complete structured reports on challenges, strengths, and observed learner engagement, as well as provide suggestions for improvements.
- Peer-to-peer feedback among educators can be used to compare methodologies and exchange best practices.

Monitoring of Learning Outcomes
- **Formative evaluation**: Continuous checks through quizzes, group reflections, and small projects ensure that learners are achieving intended outcomes during the modules.
- **Summative evaluation**: Final assessments, such as practical projects (e.g., light pollution audits or awareness campaigns) and theoretical tests, confirm that the expected competences have been acquired.
- **Competence mapping:** against the European Qualifications Framework (EQF) ensures alignment with vocational education standards.

Program Implementation Quality

- Review of learning materials and their compliance with accessibility and sustainability guidelines.
- Analysis of organizational aspects: scheduling, duration, technical conditions, and learning environment.
- Assessment of engagement level: attendance rates, timely submission of tasks, and active participation in collaborative activities.

Long-Term Impact Assessment

- **Follow-up surveys** (3–6 months after program completion) to evaluate the transfer of knowledge and skills into professional or community contexts.
- Collection of **success stories and case studies** from participants who implemented EcoLume principles in their workplaces, schools, or municipalities.
- **Stakeholder feedback** (e.g., from partner organizations, employers, or community leaders) on how the program outcomes contribute to broader sustainability and environmental education goals.

Data Analysis and Reporting

- All data gathered through surveys, assessments, and reports should be systematically analyzed to identify trends, strengths, and areas for improvement.
- Results must be summarized in an annual evaluation report, shared with project partners, educators, and stakeholders, ensuring transparency and compliance with Erasmus+ and EU VET quality standards.
- Based on these findings, the curriculum should undergo continuous improvement cycles, adapting content, methods, and resources to future learner needs.

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