# DELIVERABLE O.1

# MAPPING COMPETENCES IN

# DAYLIGHTING

Insights from Stakeholder Workshops and Surveys

across Four European Nations

## Abstract

This document reports the results of the first Intellectual Output O1 "Definition of Competences". Between January and February 2021, 14 workshops were conducted in the four partner countries (Italy, Denmark, Sweden and Poland). Sixty-four experts and stakeholders from the associated partnership network were involved. The result was a compilation of testimonials on the motivations of those working with daylighting, on the directions for courses on the elearning platform and on future summer schools. This set of information is the basis for the creation of the NLITED project's training offer consisting of an eLearning platform and two summer schools.

| DELIVERABLE CONTROL PAGE | |
|---|---|
| Deliverable Title | Mapping Competences in Daylighting: Insights from Stakeholder Workshops and Surveys across Four European Nations |
| Deliverable Number | O1 |
| WP number | O1 |
| Authors | Mandana Sarey Khanie (DTU), Mikkel Kodof Pedersen (DTU), Federica Giuliani (Unicusano), Valerio R. M. Lo Verso (Polito), Niko Gentile (LU), Pimkamol Mattsson (LU), Federica Caffaro (Roma3), Natalia Sokol (PG), Marta Waczynska (PG) |
| Short Description | This document reports the results of the first Intellectual Ourput O1 "Definition of Competences". Between January and February 2021, 14 workshops were conducted in the four partner countries (Italy, Denmark, Sweden and Poland). 64 experts and stakeholders from the associated partnership network were involved.<br><br>The result was a compilation of testimonials on the motivations of those working with daylighting, on the directions for courses on the eLearning platform and on future summer schools. This set of information is the basis for the creation of the NLITED project's training offer consisting of an eLearning platform and two summer schools. |
| Contributors | P1: Danmarks Tekniske Universitet (DTU)<br>P2: Università Niccolò Cusano (Unicusano)<br>P3: Lunds Universitet (LU)<br>P4: Politechnika Gdańska (PG)<br>Associated partners:<br>P5: Politecnico di Torino (Polito)<br>P6: Università degli studi Roma Tre (Roma3) |
| Language | English |
| Date | March 2021 |

## Table of content

# NLITED O1 REPORT

## 1. Introduction

### 1.1. The NLITED project

New Level of Integrated TEchniques for Daylighting education (NLITED) is an educational project co-founded by the Erasmus+ Programme of the European Union (Project Ref: 2020-1-IT02-KA203-079527). The project aim is to improve le knowledge on daylighting of both students and professional of the building sector.

NLITED is a proposal for a new education project with the following objectives:

- filling existing knowledge gaps by <u>introducing</u> a comprehensive blended learning model for knowledge and better integration of daylight into architectural projects, starting from theory to state- of-the-art daylight simulation.
- raising awareness and knowledge among experts in the field on shortcomings of knowledge transfer in BPS realm.

### The strategic partnership

A partnership of four European universities has developed the concept of NLITED:

Four universities from different European countries carrying out its implementation.

• **Università Niccolò Cusano – Italy (Headleader)**

• **Danmarks Tekniske Universitet – Denmark**

• **Politechnika Gdańska – Poland**

• **Lunds Universitet – Sweden**

Choice of partners

The four partners involved in the implementation of the education package represent three distinct European geographical areas facing different challenges in daylighting design.

- **Northern Europe countries (Denmark, Sweden**) face daylight design challenges in terms of highly changing availability of daylight during the year and low solar angles, increasing, e.g., risk of glare.
- **Central Europe countries (Poland)** must deal with the often-cloudy sky and constantly changing weather conditions.
- **Southern European countries (Italy)** face challenges in terms of excessive solar heat gains during some months.

In addition to the main academic partners, a local network of stakeholders has been built for each participating country. Thei r role is to ensure that the training proposal can have a real impact on the social context of the territories involved. They have been included as associated partners and divided into five categories (Figure 1):

- Universities
- Building Associations
- Building Companies
- (day)Lighting Associations
- Dissemination sector as trade journals, professional magazines.

Associated partners are involved in defining educational needs, recruiting learners, and publicising the proposal and its results.
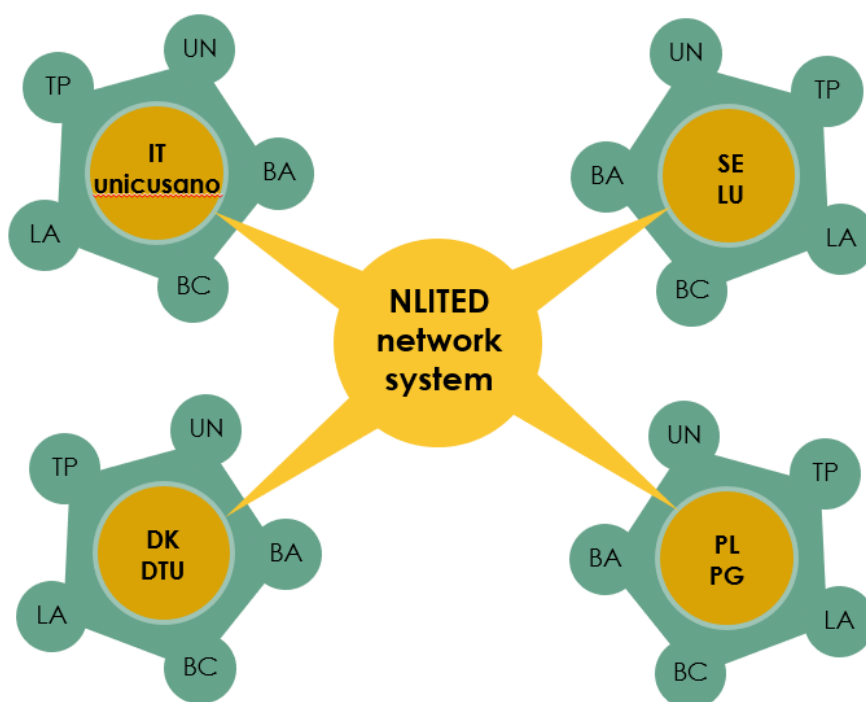
*Figure 1: The NLITED network includes associated national partners. They are other Universities (UN), Building Associations (BA), Building Companies (BC), (day)Lighting Associations (LA) and bodies from the Dissemination Sector (DS).*

### 1.2. The investigation O1

The NLITED project conducted workshops in Denmark, Italy, Poland, and Sweden, engaging a diverse group of professionals, researchers, and project partners. The investigation was based on workshops and an online survey.

The workshops aimed to provide valuable insights into the field of daylighting design across four European countries. Workshops are a valuable initiative to understand daylighting design's current state and future trends across these European countries. The aggregated summary showcases the rich diversity of perspectives and expertise that contributed to the NLITED project's effectiveness.

## 2. The experts sample

### 2.1. Danish sample

Three workshops with twelve professionals from eight companies were organized in Denmark. The workshop included from minimum of two to a maximum of five professionals. For the two first workshops all attendants represented different companies, while the last workshop was only represented by one organisation, which was due two cancellations from industry invitees.

Half of the participants came from the industry, which was represented by architecture studios, consultancy firms and manufacturing companies of windows and solar shadings. All companies are medium to large sized. The companies represented were VELUX, Royal Danish Academy, VIA University College, KHR Architecture, MicroShade, Henning Larsen Architects, MOE, Arkitema.

The gender mix of the professionals invited to the Danish workshops was balanced – 6 females and 6 males. Most of the professionals had more than 10 years of experience working with daylight design, which also had an influence on the age groups represented as, again, the vast majority was above 40 years of age. The industry participants are mixed in roles, ranging from managers to designers.

*Table 1. Background information of the Danish professionals participating in the workshops. Year of experience with daylight design and age class should be read as rough interpretation (no direct question was asked). Professionals not dealing directly with daylighting in their daily work are marked with "na".*

| Code | Date | Year of experience daylight | Gender | Age class | Role | Organisation |
|---|---|---|---|---|---|---|
| DK-01 | 03/02/2021 | >10 | m | >40 | Architect | VELUX |
| DK-02 | 03/02/2021 | >10 | f | >40 | Associate Professor | Royal Danish Academy |
| DK-03 | 03/02/2021 | >10 | f | >40 | Associate Professor | VIA |
| DK-04 | 03/02/2021 | >10 | m | >40 | Head of Research | KHR |
| DK-05 | 03/02/2021 | >10 | f | >40 | Head of Technical Support | MicroShade |
| DK-06 | 08/02/2021 | >10 | m | >40 | Senior Researcher | VELUX |
| DK-07 | 08/02/2021 | >10 | f | >40 | Assitant Professor | Royal Danish Academy |
| DK-08 | 08/02/2021 | 5-10 | m | 30-40 | Lead Computational Design | HLA |
| DK-09 | 08/02/2021 | >10 | f | >40 | Lighting Designer | MOE |
| DK-10 | 08/02/2021 | >10 | m | >40 | Senior Consultant - sustainability | Arkitema |
| DK-11 | 11/02/2021 | >10 | f | >40 | Teaching Associate Professor | Royal Danish Academy |
| DK-12 | 11/02/2021 | >10 | m | >40 | Associate Professor | Royal Danish Academy/ UNIPR |

The workshops took place between 3 March and 11 March 2021. Two representatives of the country coordinator (Technical University of Denmark, DTU) attended and hosted the workshops. Besides the invited professionals attending, the workshops were also joined by one representative of the project coordinator (Unicusano), whose role involved presenting the NLITED project and otherwise mainly act as an observer or answer questions that the professionals raised. One partner from DTU moderated the workshops, guiding them through the discussions and questions of interest, while the other partner observed and took notes.

### 2.2. Italian sample

Four workshops with nineteen professionals and researchers were organized in Italy. Each workshop included from a minimum of four to a maximum of five people, but a minimum of one from design consultancy was represented in each workshop.

More of half of the participants (eleven out of nineteen) came from the university, even if some of them were also representatives of design studios. The universities represented were: Università di Parma, Politecnico di Torino, Sapienza Università di Roma, Università Federico II di Napoli, Università Roma Tre, Universitat Politècnica de Catalunya, ETH Zürich.

The professionals represented from small to large sized companies by architecture studios, consultancy firms and manufacturing companies of windows and solar shadings. VELUX, FINESTRAL, all companies are medium to large sized. The companies represented were Ai Engineering Srl, AR Lighting, Traverso&Vighy studio, Finstral, LEED, and VELUX.

The participants were balanced in gender, with nine female and ten male participants.

There were Eleven people were from academia, seven from design and consultant field, and two with other roles. Almost half of the participants were over forty years old, and the other half were between thirty and forty years old. In terms of experience, there was a balance between people with more than ten years of experience in daylighting design, less than ten years and less than five years. The sample, in other words, is quite representative of young and senior experts in the field of daylighting design. Many of the people came from academia, but the reason is that in Italy, there is still not a large presence of experts in the market.

*Table 2. Background information of the Italian participants in the workshops. Year of experience with daylight design and age class should be read as rough interpretation (no direct question was asked).*

| Code | Date | Year of experience daylight | Gender | Age class | Role | Organisation |
|---|---|---|---|---|---|---|
| IT-01 | 16/02/2021 | <10 | F | 30-40 | University - Researcher | University Roma Tre |
| IT-02 | 16/02/2021 | >10 | M | >40 | University - Researcher | Politecnico of Turin |
| IT-03 | 16/02/2021 | >10 | F | >40 | Architectural lighting designer | AR Lighting |
| IT-04 | 16/02/2021 | <10 | F | 30-40 | University - Researcher | Sapienza University of Rome |
| IT-05 | 16/02/2021 | <5 | F | 30-40 | University - Researcher | UPC - Catalunya (ES) |
| IT-06 | 17/02/2021 | >10 | F | >40 | University - Professor | University Federico II of Naples |
| IT-07 | 17/02/2021 | <10 | F | 30-40 | University - Researcher | University Federico II of Naples |
| IT-08 | 17/02/2021 | >10 | M | >40 | Industry - Consultancy / design | Traverso&Vighy studio |
| IT-09 | 17/02/2021 | <5 | M | 30-40 | Industry - Consultancy / design | Ai Engineering Srl |
| IT-10 | 17/02/2021 | >10 | M | >40 | Commercial | Finstral |
| IT-11 | 22/02/2021 | <10 | F | 30-40 | Industry - Consultancy / design | VELUX |
| IT-12 | 22/02/2021 | <5 | F | 30-40 | Environmental specialist | LEED |
| IT-13 | 22/02/2021 | >10 | M | >40 | University - Professor | Sapienza University of Rome |
| IT-14 | 22/02/2021 | <10 | M | >40 | Consultant | VELUX |
| IT-15 | 22/02/2021 | n/a | M | >40 | Industry - Consultancy / design | Consiglio Nazionale Architetti |
| IT-16 | 25/02/2021 | >10 | F | 30-40 | University - Researcher | Parma University |
| IT-17 | 25/02/2021 | <5 | M | >40 | University - Researcher | Parma University |
| IT-18 | 25/02/2021 | <5 | M | >40 | University - Researcher | Politecnico of Turin |
| IT-19 | 25/02/2021 | <5 | M | <30 | PhD student | ETH Zürich |

The workshops took place between 16 and 25 February 2021. Beside the professionals, three of the project partners attended each workshop, one representing the country coordinator (Unicusano), one representing the Swedish side (Lund University) and one representing a project partner (Politecnico di Torino). A partner from Unicusano acted as moderator, leading the discussion, posing questions and keeping the timing. The partner from Politecnico di Torino acted as observer, took notes, and helped keeping the timing. Finally, the Lund University partner participated as external observer, listened to the conversation. The professionals held the conversation, while the three project partners joined the discussion only if needed or prompted.

## 2.3. Polish sample

Three workshops were organized in Poland between February 11 and February 16, 2021, bringing together twelve professionals and researchers in the field of daylighting design. Each workshop had a minimum of two and a maximum of five participants, ensuring a diverse range of perspectives. Notably, each workshop included at least one representative from a design consultancy, emphasizing a multidisciplinary approach.

The three workshops were divided into specialists: the first was for researchers, the second for industry and the third was for teachers. Notable participants included Sweco, Deltacodes Sp. Z.o.o.,

ARUP, 2G Studio, and Aalborg University. This diverse representation underscored the workshops' engagement with professionals from different segments of the industry.

Gender balance was achieved among the participants, with nine female and three male attendees, reflecting a commitment to inclusivity and diversity.

In terms of professional roles, the participants were divided as follows: eleven researchers, one consultant, and one architect. This distribution ensured a rich exchange of ideas and experiences among participants with different expertise.

Age and experience in the field of daylighting design also varied. Approximately half of the participants were above forty years old, while the other half fell within the thirty to forty-year age range. Similarly, there was a mix of individuals with varying levels of experience in daylighting design, including those with more than ten years, less than ten years, and less than five years of experience. This diversity of experience levels and age groups made the participant sample representative of both emerging and seasoned experts in the field.

*Table 3. Background information of the Polish participants in the workshops.*

| Code | Date | Gender | Role | Organisation |
|---|---|---|---|---|
| PL-01 | 11/02/2021 | f | Researcher | ISOCARP |
| PL-02 | 11/02/2021 | f | Researcher | TU Berlin |
| PL-03 | 12/02/2021 | m | Consultant | Sweco |
| PL-04 | 12/02/2021 | m | Commercial | Deltacodes Sp. Z.o.o. |
| PL-05 | 12/02/2021 | f | Designer | ARUP |
| PL-06 | 12/02/2021 | m | Architect | 2G Studio |
| PL-07 | 12/02/2021 | m | Consultant | Aalborg Univeriset |
| PL-08 | 16/02/2021 | f | Professor | UTP Bydgoszcz |
| PL-09 | 16/02/2021 | f | Professor | Gdansk University of Technology |
| PL-10 | 16/02/2021 | m | Professor | Silesian University of Technology |
| PL-11 | 16/02/2021 | f | Assistant professor | Bialystok University of Technology |
| PL-12 | 16/02/2021 | f | Professor | Gdansk University of Technology |

## 2.4. Swedish sample

Four workshops with twenty-one professionals from thirteen companies were organized in Sweden. The workshop included from minimum of three to a maximum of eight professionals, but maximum five companies were represented in each workshop.

Most professionals came from the industry (eighteen out of twenty-one), either construction and architectural companies or consultancy firms working in the design and construction industry. Two participants were educators, and one participant represented a public agency. All the professionals represented medium to large sized companies, with thirty employees or more. The companies represented were Skanska, SWECO, ACC Glas, RISE (Research Institute of Sweden), Fojab architects, WSP, White Architects, Inter IKEA, The Swedish Authority for the Work Environment, Oki Doki Architects, KTH Royal Institute of Technology, Technical University of Delft.

The participants were balanced in gender, with ten female and eleven male participants. The participants were also balanced in terms of professional roles, with roughly nine managers – or with positions like the managerial ones -, eight designers, and four with other roles. Only six professionals were above forty years old and only six – not necessarily the same six - had more than ten years of experience in daylighting design. This indicates that modern daylighting design is a young discipline and confirms that only in recent years daylighting is slowly re-emerging as a subject in architectural and engineering schools.

*Table 4. Background information of the Swedish professionals participating in the workshops. Year of experience with daylight design and age class should be read as rough interpretation (no direct question was asked). Professionals not dealing directly with daylighting in their daily work are marked with "na".*

| Code | Date | Year of experience daylight | Gender | Age class | Role | Organisation |
|------|------|------|------|------|------|------|
| *SE-w01* | 22/01/2021 | na | m | >40 | Manager - Energy design | SKANSKA |
| *SE-w01* | 22/01/2021 | <5 | f | <30 | Architectural lighting designer | SWECO |
| *SE-w01* | 22/01/2021 | <5 | m | 30-40 | Architectural lighting designer | SKANSKA |
| *SE-w01* | 22/01/2021 | >10 | m | >40 | Management - daylighting specialists | ACC Glas |
| *SE-w01* | 22/01/2021 | <5 | f | <30 | Architectural lighting designer | SKANSKA |
| SE-w02 | 25/01/2021 | na | m | 30-40 | Management | RISE |
| SE-w02 | 25/01/2021 | <5 | f | 30-40 | Environmental specialist | Fojab |
| SE-w02 | 25/01/2021 | >10 | f | >40 | Manager - Environmental specialist | Fojab |
| SE-w02 | 25/01/2021 | 5-10 | f | 30-40 | Environmental specialist | Fojab |
| SE-w02 | 25/01/2021 | 5-10 | m | 30-40 | Architectural lighting designer | SWECO |
| SE-w02 | 25/01/2021 | 5-10 | f | 30-40 | Manager - Architectural lighting design | SWECO |
| SE-w02 | 25/01/2021 | 5-10 | m | 30-40 | Environmental specialist | White |
| SE-w02 | 25/01/2021 | >10 | m | >40 | Industry - Consultancy / design | WSP |
| SE-w03 | 26/01/2021 | 5-10 | m | 30-40 | Environmental specialist - focus on daylight performance of fenestration systems | ACC Glas |
| SE-w03 | 26/01/2021 | >10 | f | 30-40 | Manager - Architectural lighting design | White |
| SE-w03 | 26/01/2021 | >10 | m | >40 | Public agency - generic | AV |
| SE-w03 | 26/01/2021 | na | m | >40 | Management | Inter IKEA |
| SE-w03 | 26/01/2021 | >10 | m | 30-40 | University lecturer - daylighting | KTH |
| SE-w04 | 22/02/2021 | 5-10 | f | 30-40 | Environmental specialist | Tengbom |
| SE-w04 | 22/02/2021 | na | f | 30-40 | Lighting designer | Oki Doki |
| SE-w04 | 22/02/2021 | 5-10 | f | 30-40 | Doctoral student | TU Delft |

The workshops took place between 22 January and 22 February 2021. Besides the professionals, three project partners attended each workshop, two representing the country coordinator (Lund University) and one representing the project coordinator (Unicusano). A partner from Lund University acted as moderator, leading the discussion, posing questions and keeping the timing. Another partner from Lund University acted as observer, took notes, and helped keep the timing. Finally, the NLITED project leader participated as an external observer, presented the NLITED project and listened to the conversation. The professionals held the conversation, while the three project partners joined the discussion only if needed or prompted.

## 2.5. Aggregated sample

The NLITED project conducted workshops in Denmark, Italy, Poland, and Sweden, engaging a diverse group of professionals, researchers, and project partners. These workshops aimed to provide valuable insights into the field of daylighting design across four European countries. Here is an aggregated summary of the combined data from all the categories:

**Workshops:** A total of fourteen workshops were organized in the four countries, involving a wide range of professionals from the field of daylighting design.

**Participants:** In total, sixty-four professionals and researchers took part in these workshops, contributing to a comprehensive understanding of the subject. These participants came from various backgrounds and roles within the daylighting design field.

**Gender Mix:** The workshops demonstrated a perfect balanced gender mix, with a total of thirty-two females and thirty-two males participating, promoting inclusivity and diversity in the field.

**Industry Representation:** Participants came from different segments of the industry, including architecture studios, consultancy firms, manufacturing companies of windows and solar shadings, and public agencies, showcasing a multidisciplinary approach.

**Company Sizes:** The represented companies varied in size, with many being medium to large-sized organizations. This diversity in company size provided a holistic perspective on daylighting design's impact.

**Universities:** Several participants came from universities, including well-known institutions such as Politecnico di Torino, Gdansk University of Technology, and KTH Royal Institute of Technology, demonstrating the academic influence on the field.

**Experience Levels:** Participants had varying levels of experience in daylighting design, with professionals having more than ten years, less than ten years, or less than five years of expertise. This diversity of experience levels ensured a broad exchange of ideas.

**Age Groups:** The participants covered a wide age range, with a mix of individuals above forty years old and those within the thirty to forty-year age range, highlighting the evolving nature of daylighting design.

**Roles:** Participants encompassed various roles, including researchers, consultants, architects, managers, and designers. This diverse representation facilitated discussions across different areas of expertise.

**Project Partners:** Project partners played essential roles in the workshops, acting as moderators, observers, and external observers, enhancing the quality of discussions and knowledge sharing.

The workshops were a valuable initiative to understand daylighting design's current state and future trends across these European countries. This aggregated summary showcases the rich diversity of perspectives and expertise that contributed to the NLITED project's success.

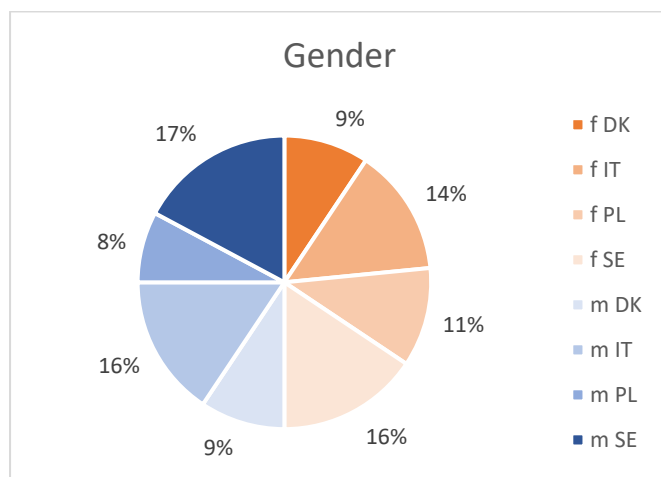*Figure 2. Aggregated data. Distribution of gender in the four countries.*



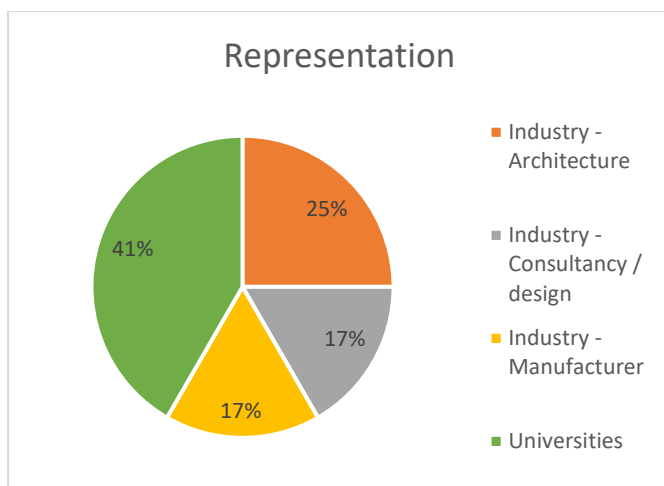*Figure 2a. A total of 64 participants (32 females, 32 males)*

*Figure 2b. Participants' main areas of work*

## 3. Methodology

Three dates in each country were selected for workshops. At least one month before the first workshop, each country coordinator sent out an invitation email to possible interested people or departments. The participants could select one of the three dates and a limit of five participants was set for each workshop. In some cases, the limit had to be stretched and up to eight participants joined a single workshop. In such cases, more of the participants represented a single company; the scope was to make sure that everybody could have chance to discuss their working routine.

The invitation email provided a brief overview of the NLITED project, described scope and duration of the workshop, and invited to forward the information to other interested colleagues. A note on ethical matters, like use of recordings and informed consent, was also provided. A copy of the invitation email is provided in **Errore. L'origine riferimento non è stata trovata.**.

One week before each workshop, the country coordinator sent out a reminder email that included a detailed agenda and the link for the digital workshop, and a draft version of the NLITED curriculum. A copy of this email is provided in Annex A.2 – Second mailing.

After the workshop, a final thank-you email was sent out to the participants. The mail included links for two questionnaires dealing with the definition of competences and a quality survey about the workshop. Email and surveys are provided in **Errore. L'origine riferimento non è stata trovata.**.

### 3.1. The workshops

The workshops were conducted either in the national language or in English, depending on the audience. All the workshops in Denmark and Sweden were held in English, while in Italy were in Italian and in Poland were in Polish. The workshops were conducted in the form of focus group with a semi-structured protocol. Each workshop lasted between 180' and 240'.

The workshop was opened with a welcome phase (3'). In this phase, the moderator acknowledged the professional for the participation and presented the project partners. Then the moderator explained the structure of the workshop, informed the participants about the treatment of personal data and the use of the results, and asked permission for recording the session.

Once the permission for recording was given, a roundtable presentation started (10'). Each participant presented herself/himself in an accessible format, but provided at least name, affiliation, professional role and professional experience with daylighting design.

Then, the project leader gave a short presentation of the NLITED project (7') and, right after that, the workshop entered in the central phase, which lasted for roughly 70'. An overview of the questions is provided in Table .

The moderator posed only the main question to the professionals. All the main questions were open-ended and required a more elaborated answer than a yes or no. If the discussion could not self-sustain, the moderator would have prompted that with the follow-up/detailed questions. The moderator and observers made sure that all the follow-up questions were covered before moving to the next main question.

*Table 5. Topics and questions for the workshop*

| Topics | Main question | Follow-up / Detailed questions |
|---|---|---|
| **Daylight design / education** | Why and how do you design for daylighting? | · Which is the goal of daylighting design in your job? *E.g., comply to standards and regulations, hedonic goal (doing better buildings than others), provide clients with renderings, ...*<br>· Do you have a group working on daylighting design?<br>· How do you assess daylight in practice? (Can you describe the typical workflows, including software, tools, …?)<br>· Which type of daylight assessment do you usually perform? (including metrics) |

| Definition of competences (eModules) | You have read our draft proposal for the course curriculum. How would you improve the proposal? | · Would you have liked to see something else there? <br> · Would you make use of the whole curriculum? <br> · Are there modules which are irrelevant for you? |
|---|---|---|
| eLearning – practicalities | How and under which conditions would your work benefit from this online course? | · How would your career benefit from it? <br> · How would your company benefit from it? <br> · Which conditions would allow you (or your colleagues) to join the course? <br> *E.g., Self-paced vs …* <br> *E.g., entering requirements…* <br> *E.g., pre-recorded material* |
| Summer school | The educational package we are creating includes a summer school. In your view, which conditions would make the summer school attractive to you? | How do you think a summer school may support learning from the course? |

The first topic, Daylight design/education, dealt with motivation for designing daylighting in the daily work, and the tools or routines used. The scope was to identify the motivational driver for daylighting design, so that the NLITED educational offer could support these drivers. The first topic was deemed of high relevance for the definition of NLITED competences and therefore up to 40' were allocated for the questions.

After the first topic, a short break was planned.

After the break, the moderator opened and briefly illustrated the NLITED draft curriculum, which was also attached to the second reminder mail. Then, the moderator asked the second main question. The two final questions concerning e-learning practicalities and the summer school, were covered right after.

## 3.2. Data analysis

The verbatim of the workshops were auto-generated via software. The software did not provide a perfect verbatim, and part of the text were re-worked manually by the authors.

The verbatim underwent to content analysis. The topics in Table 5 were used as analysis matrix for the content analysis. The topic "Daylight design/education" was deemed highly important, as it motivates daylighting design. Therefore, this topic was further analysed by using an analysis matrix based on the Goal-Framing Theory (Lindenberg and Steg, 2007, 2013), see Table 6. Goal-framing theory deals with the power of goals to govern cognitive and motivational processes and focuses on three overarching goals: hedonic, gain, and normative goals.

*Table 6. Analysis matrix for the motivation driving daylighting design, based on the Goal-Framing Theory*

| Goal | Have the following statements or similar ones been mentioned or reflected during the workshops? How? Any relevant quotes? |
|---|---|
| Normative goals | · There are legal requirements for daylight design, then I must do that <br> · It is part of my company policy/workflow to make this type of assessment, then I must do that <br> · There are the requirements for daylight standard and/or certificates that I must be considered and follow <br> · It is parts of sustainable building design (associated with energy-saving, good indoor environment, health and well-being) that I, as a professional, feel obligated to do |

12

| Gain goals (gaining status/resources) | · Working with daylight design is a way to enhance my skills, knowledge and competences<br>· It is a way to advance my professional development as a daylight expert/daylight specialist<br>· It is a way to increase values of my work (e.g., aesthetics, pleasantness, and good quality architecture)<br>· Having competences in daylight design would attract more clients/students as well as those who concern about the importance of daylighting |
|---|---|
| Hedonic goals (their own pleasure, pride; own values, e.g., well-being and health) | · Working with daylight design is interesting and/or exiting<br>· Daylight design is challenging and carrying out the task is my great achievement<br>· There are strategies, methods and tools available to me and make it easier to work with daylight design (in general and at different design stages)<br>· Daylight design is a pleasure task to work with and would bring about many benefits |

The two responsible researchers coded the seminar transcripts separately and then, compared codes. Disagreements found were discussed and recoded upon agreement of the researchers.

IO1 coordinator please complete.

## 4. Results

### 4.1. Denmark

#### 4.1.1. Motivations

One participant expressed that normative goals are the driver in their daily work with daylight design. However, this was expressed in an almost disappointing fashion.

DK-09: "*What we do with daylight is mainly proving that the regulation is fulfilled. Unfortunately, that is mainly by this local rule we have in Denmark with the 10% (glass area to floor area). Because we developed a very quick method to do that. Our own spreadsheet.*"

DK-09: "*When we have the chance, and that is when the building program sets higher demands, we work integrated, so daylight, solar heating, energy consumption together and then we can get much better results. But that is when the clients put these demands.*"

While the first of the above comments is based on normative goals, which again, is the driver for their work with daylight design, there is also a hint of hedonic goals, i.e., that they developed a spreadsheet to make it quick and easy to evaluate. However, DK-09 also mentioned that they do sometimes work integrated in different disciplines of energy and indoor environment to gain better results (gain goals). However, this gain goal is mostly driven by their clients. This showcases that when the clients want better buildings, i.e., design decisions based on more than the bare minimum regulations (normative goals), they (read: clients) can have an impact on the motivation of daylight design. For the clients, or building owners, demanding more than the minimum can lead to various sustainability building certification schemes, and thus add value to the building or improved status of the company (gain goals).

Aiming for the rule of thumb, or the step just above rule of thumb, in terms of daylighting design is seen as a normative goal. However, DK-08, admittedly expressing that some of their workflows aim at just the step above rule of thumb (normative goals), they also do so because it is very easy for their architects to do daylight simulations with these easy workflows (hedonic goals).

DK-08: "*I don't know if it is old school, but we are sort of stuck in old habits on using Daysim for a lot, unless we have very complex facades. Because Daysim gives us, like the step above rule of thumb. It's very easy to use, and we have some workflows that makes it very easy to take some geometry from the architects and assign properties to the glass and hit run.*"

DK-08: "*(talking about using simple, and more conservative, simulation methods) … And we can understand the results. One thing is being conservative, but if we do it in the same way in a lot of projects, we can revisit the projects afterwards and we can evaluate, what did this colour in the simulation mean, and we sort of have a common language in the studio about it.*"

DK-03 also mentioned from experience when meeting practitioners, that the driver is to document sufficient daylight (normative goals). Although DK-03 did not express this was the case for DK-03 personally in this comment, it reveals that for practitioners enrolling in daylight courses, the motivation for doing so is highly driven by normative goals, i.e., linking knowledge to evaluation methods for compliance.

DK-03: "*I have been meeting practitioners in different daylight courses, and one of the demands they have is also to link this knowledge to something concrete and buildable. So, for example, in Denmark, we have some requirements according to daylight. And where they would be interested in learning these particular tools, for example the 10%-rule or the 300-lux method to document sufficient daylight.*"

This was backed up by DK-05, who also raised concern about the knowledge on how to use evaluation methods to document compliance (normative goals). Specifically, DK-05 has experienced that practitioners are in doubt on how to do the compliance evaluation methods correctly.

DK-05: "*Usually I am in contact with engineers and architects in projects and they are going to implement some kind of solution to get their building to work both daylight, energy, and indoor climate wise. I think what is mostly discussed in the moment is often which methods to be used to evaluate the daylight conditions. Because we have had this new European daylight standard, but it is still very new. So, people are not familiar with it yet and they are very much in doubt of how to do it; is this the right method for this project or should I rather do something else? In the Danish building regulations, you have the option to choose the method you prefer, it is not specified that you should use a specific one. There can be examples of methods you can use. That is at least my impression. Which evaluation method to use in which cases? […] I think it is very difficult to decouple it from the legislation in different countries.*"

DK-05 also expressed a personal opinion on building good buildings for the people that are going to occupy them (gain goals). This can be done by working more integrated and not seeing daylight as just one parameter but seeing how it interchange with other aspects of indoor climate.

DK-05: "*(while talking about an integrated approach of daylight- and energy) And just as DK-03 also mentioned, I have been very occupied with having architects and engineers talking more together so we have a more integrated process, so that we actually build good buildings for the people that are going to stay in there afterwards. It is good that we can make buildings with good daylight, but if they are very poor on indoor climate it is not a good building, and also the other way around. I think daylight cannot stand alone; we need to look at it in a broader perspective. Of course, we need to know something about daylight, so for this purpose you need to have some kind of indication of daylight, but when you do buildings, you need to put it into a broader perspective than just looking at daylight.*"

In the Danish workshops the urban design or city planning was addressed by multiple people, raising concern of the knowledge of daylighting design among city planners.

DK-03: "*The project I told you about that we are working on right now has a focus on the effect of urban planning. The exterior obstacles have a huge influence and impact on what happens in the buildings. I know the course is not about this, but I think it will be important to address as well. This is actually a problem is real life, that many of the practitioners are dealing with because they cannot do anything with the local plans because they are already established. We are actually looking at some case studies where there are non-existing solutions for those. I think it is important to address the urban context as well.*"

In the above comment the non-existing solutions should be understood as non-existing solutions for compliance (normative goals). This issue was also addressed by other people, linking the city planning to the ability to fulfilling requirements (normative goals).

DK-10: "*Right now, we are doing a research project together with MOE and VIA University. Trying to say okay, we have these different scales, city planning, site, building level. But it is important to be able to, when you do optimization and calculation of daylight, it is important that you can do these analyses based on what you need to fulfil inside your buildings. So, you can use your results from your very early stage, city planning, daylighting design to fulfil the requirements in buildings, and also to improve daylight quality in the buildings afterwards. So not just seeing daylight at something you should analyse for your building, but really start at the starting point in your design at the city planning.*"

DK-08 agreed upon this issue of lacking knowledge of city planner. DK-08 mentioned the same issues as mentioned by DK-03, i.e., that if the city planners lack knowledge of daylighting design, they can make it difficult for the architects to reach the requirements (normative goals) – DK-08 expressed that architects can become restricted by the city planning.

DK-08: "*I will just chip in. It is a very valid focus point that DK-10 is raising here. Because I think, when we look at education and bringing up the overall level of knowledge on daylight, then it is not only architects, but also city planners that need to get onboard somehow. Because there are lots of architects sitting in a role where the master planner has locked them into a volume or geometry, where you are sort of very restrained.*"

To overcome this issue, DK-10 mentioned that they have city planning as part of their work, expressing that it is an important part of what they offer, besides architecture. It is important for their city planners to have some knowledge on daylighting design, including having tools and rules of thumb. This will eventually make it easier (hedonic goals) for their architects to do daylighting design and document compliance (normative goals).

DK-10: "I*n our departments both in Denmark, Norway, and Sweden, city planning is also part of what we offer. So, for us it is very important that city planners also know how to take daylight into account, and get some tools and rules of thumb, so what is important in city planning in terms of good daylight.*"

Participants – from two companies that sell windows or solar shadings – mentioned their involvement in developing tools for daylighting design.

DK-01: "O*ne of the activities I work with, which is relevant in this context, is [VELUX] Daylight Visualizer, that we developed for daylighting analysis of buildings. The goal of this software was to kind of make something like Radiance available to architects and engineers, with a much simpler interface, and something that is close to their (read: architects) CAD programs. That has been quite popular both from an educational perspective but also in practice.*"

DK-05: "*(while talking about an integrated approach of daylight- and energy) We have developed a workflow that can do this, and we have a tool that is online on our webpage, it is called SimShade, where you can try to simulate different kind of solar shading devices both in terms of daylight but also on the indoor climate.*"

The above comments display examples of both hedonic and gain goals. Both tools are created with the purpose of making life easier for clients/users/students (hedonic goals), while at the same time it provides status or resources for the creators of the tools (gain goals), which may attract more clients and increase the public knowledge of the company and their activities. While these comments are based on gain and hedonic goals, one could argue that the development of the tools are also driven by normative goals, as the tools are also developed for practitioners to document compliance or used to make design decisions during the design phase, that are eventually going to be documented for compliance.

Though DK-09 mentioned that their (read: the company) main tasks related to daylighting design is to prove compliance (normative goals), DK-09 also had a very strong opinion, when the talk went into simulation versus reality.

DK-09: "*(talking about simulation versus reality) But I think you should do the effort of finding a real space, and sit there and experience, what is the glare ratio. […] And maybe bring your grandmother because she will have a completely different perception of glare. I think it is so extremely important that simulations are connected to reality. I have an example where we had two guys standing, one was an architect saying 'look in the space', and you have the engineer saying 'it is creating glare', or maybe the other way round. […] The most important thing is that we do this for people, we don't do it for an energy analysis, we do it for people. I see so many times going through analyses that don't relate anyhow to people. The young people at universities are so intelligent, and so skilled with computers. They just have to understand that the truth is in our eyes, not in a computer. And it is so important because all simulations are based on male 32 years old, you have to bring a woman 60 years old… or a man. Because it is so different.*"

The above comment reveals a personal desire to go beyond the norms. DK-09 talked passionately using words such experience, perception, and glare, which one perhaps naturally will associate more with gain goals. DK-09 also expressed that daylighting design should be performed with people in mind, and not for an energy analysis, which is associated more with normative goals.

For the participants coming from the academic world (read: architecture school), their motivations were more driven by hedonic goals, expressing words such as aesthetics, atmosphere, qualities of daylight, interpretation, imagination, and comfortable rooms.

DK-02: "*My search is both concerned about bettering the facilities at the light lab, and also I am very much into the aesthetics of light, both artificial and daylight.*"

DK-07: "*Where I am very occupied the aesthetics of daylight, the aesthetics of architecture as well. Of course, it relates to each other, as well the atmosphere of daylight, the qualities of daylight and so on.*"

DK-11: "*We take the output from the rendering, the different sections, light, whatever, and then we work in Photoshop. So that is the creative part where we get away from what is physically correct, or getting further away from the simulation part, and more into the interpretation. Your imagination of what it would be. It is much more about atmosphere, to convey some kind of a, what would it be to be in this room. […] Shadows do not have the same colour, you have colour bleeding from the context, so the light is sort of coloured off whatever is outside the window. So, it is a bit, you can call it artistic interpretation, but we see it as an important tool, and trying to create spaces with light, scenarios, comfortable rooms.*"

### 4.1.2. Definition of competences and practicalities

*Linking knowledge to regulation/legislation*

One participant raised the issue on how to deal with a national level versus international level regarding compliance, standards, and building regulations. Although there are shared building certification schemes used in a wide variety of countries such as BREEAM, LEED, DGNB, and WELL, many countries have some specific guidelines in the local building regulations. Furthermore, the relevance of the different building certifications varies from country to country. The participant told from experience, that when meeting practitioners at various daylight courses, one of the demands they have is to be able to link the knowledge to something concrete, i.e., legal requirements for sufficient daylight, and that this likely will be the case for practitioners taking the online course, since they are dealing with these matters in their daily work. When creating a transnational online course, tackling the national level versus international level naturally becomes a challenge. Creating country specific content variations can solve this issue, however, it would perhaps damage the feeling of a shared community among students in different countries, and further challenge the digital transnational collaboration between students. Finally, it was mentioned that it would be good if the students understand that standards are the framework for building regulation and the certification schemes are an added level to document the quality of the building.

In continuation of the talk about the national level versus international level, there was also a wish to highlight the different evaluation methods. The participant that highlighted this mentioned that, when facing engineers and architects searching for a solution to their building design that solves daylight, indoor climate, and energy, they are often unsure which evaluation method to use. It was for example mentioned that familiarity with the new European Standard for daylighting in buildings (EN 17037) is still lacking, and practitioners are in doubt on which method to use in their specific case. This was followed up by linking the evaluation methods to different programs that can calculate the needed daylight metrics for documentation and compliance. The participant summarised that the two questions often received are "Which evaluation methods to use in which cases? What kind of program should I use?".

It was added that for the students it is important to talk about the process of a project as well. Students should understand the timeline of a project because the simulation tools can be used in different aspects depending on whether the project is in an early sketch phase or a final design phase. "The understanding of the process of who is doing what and when is important for students when they are coming out afterwards."

*Knowledge, skills, competences*

The learning objectives were brought up – or rather how the learning objectives would be formulated. One participant suggested having learning objectives on a knowledge level, skill level, and competence level.

Besides introduction to performance indicators, measurement, and how to quantify daylight, it was also highlighted that there should be emphasis on all things that are affecting the quality of the simulation, i.e., context, materials, and Radiance parameters. Having accessible tools that the students can play with and get feedback from are important. Instead of simply giving the user a number on a grid or a work plane output, it is great if the students can experiment how the daylight is in a room. It was added that there is also value in debugging the model. At first, students may not be able to recognise anomalies in the results, but this is an important aspect to be able to verify that the model is correct, and the simulation seems to work. It was continued by "one area is the quality of the evaluation and not just blindly read the numbers the program outputs. Maybe one of my headlines here is that the tools are actually a medium for teaching."

The topic of gamification (of tools) was received as interesting by several participants. The surrogate daylight model is one example of a tool, that in a video-game manner, allow the users to interact and play. "… the more gaming the better.", one mentioned, and followed up with stressing the importance that we should work with daylight for people, and such there should be a balance between the simulation and the actual perception, which was followed by "The young people at universities are so intelligent, and so skilled with computers. They just have to understand that the truth is in our eyes – not in a computer." As such, to develop models like the surrogate daylight model, the model designs, including geometry, daylight metrics, and changeable parameters, should be carefully selected to relate it to the real world as much as possible.

*Balancing simulation and observation – a holistic view*

Working with daylight design in a holistic way was mentioned by one participant and agreed upon by the whole workshop panel. In more specific terms, the words simulation and observation were mentioned. It is important that simulation and observation are linked and carried out all the way – if possible. The stereotypes may be an engineer working more in-depth with simulations – the quantitative – and an architect working more in-depth with observations – the qualitative. "Because in order to work together, people need to understand the differences between simulation and observation", was added. The importance of a holistic view was stressed, and it was also suggested to make the teaching modules more complex integrating different inputs into one module, eventually allowing the modules to have a more holistic content. It is important to know what simulations can do, and what simulations cannot do. The holistic view should be rooted in all of it.

On the holistic view, it was also suggested to relate it to something in the real world around us. Since the course is transnational, it will not be possible to select a landmark building that everyone can relate to as a way of gaining a feeling of daylight. A suggestion to this was to include an exercise where – after a simulation of a generic model – the students should do a simulation of their own dwelling or room. This way it can easier be related to something real. It was suggested to have students observe their dwelling or room over a period of one week, where they run point-in-time simulations to observe for example the direct light in comparison to what they can see beyond the computer screen. Getting a feeling and intuition for daylight is important, which was followed up by "… and start sort of an intuition, a language for these things, rather than just saying so many percent of the year it is above the threshold."

The specific exercise that was suggested, was commented on by another participant, who has experience with doing something similar with students. However, only over a period of two day, it includes measuring the spaces in their dwelling, taking photographs in a span of 12 hours, as well as when the light changes. Furthermore, the students should draw the section of the street to add the urban context, and this way understand where and why the sky is in the living room for example. It was mentioned that it is an extremely powerful tool to give the students a better understanding of feeling and perception of daylight, since they get the objective look upon their living room, which they look at and inhabits on an everyday basis. The fact that NLITED is a transnational project that aims to target people from a wide variety of countries, could add a further interesting layer to such an exercise, since it would be possible to experience all the differences of how we live across Europe, and

how we inhabit our spaces, and especially the spaces close to the windows – adding an anthropological aspect to it as well.

*City planning and urban scale*

An aspect that was a large talking point, was city planning and urban scale. Exterior context and obstacles have a huge influence and impact on what happens in the building. "… daylight starts outside the building. It could be interesting to put some emphasis on the outdoors.", one said. There was a general wish to address this issue as well. One participant, who is working on a project related to daylight and urban planning, told that they are dealing with some case studies where there are no existing solutions, because the local plans are already established – so the practitioners cannot do anything to find suitable solutions in terms of daylight inside the building.

To enhance and bringing up the overall level of knowledge on daylight, one participant mentioned that besides architects, engineers, and lighting designers, city planners also need to get onboard. This is evident in the fact that there are many architects sitting in a role, where the master planner has locked them into a volume or geometry that restrains the architects. In that sense, daylight should not merely be something you should analyse for your building, but the starting of your design is in the city planning.

More specifically topics such as distances between buildings, building shapes, material properties in the streets, and vegetation was mentioned. One also mentioned that it could be interesting to include more soft topics. Daylighting can be stretched to how nature can become part of the daylighting strategy, but also how view of sky and view of nature becomes qualitative aspects of daylighting. In addition, the topic of biophilic design was suggested.

### 4.1.3. Key takeaways from the Danish workshops

**Motivations for Daylight Design:**

1. **Normative Goals:** Many participants in Denmark are motivated by the need to comply with building regulations and standards related to daylighting (normative goals). They often work to prove that regulatory requirements are met.
2. **Hedonic Goals:** Some participants have developed tools and methods that make it easier to work with daylight simulations, which not only help in compliance but also enhance the ease and satisfaction of their work (hedonic goals).
3. **Gain Goals:** Gain goals are also present, as participants from companies involved in selling windows and solar shadings mentioned developing tools for daylighting design. These tools not only make life easier for clients but also contribute to the status and resources of the companies.
4. **Client-Driven Goals:** The motivations of some practitioners are driven by the demands of their clients. Clients requesting better buildings with higher daylight quality can lead to greater sustainability and compliance with building certification schemes (gain goals).
5. **Holistic Perspective:** Some participants emphasized the importance of holistic daylight design, considering not only quantitative aspects but also the qualitative experience of daylight in buildings.

**Definition of Competences and Practicalities:**

1. **Linking Knowledge to Regulation/Legislation:** Participants discussed the challenge of dealing with national versus international compliance, building regulations, and certification schemes. It was suggested that the online course should help practitioners link knowledge to concrete legal requirements for sufficient daylight.
2. **Balancing Simulation and Observation:** A holistic approach to daylight design, balancing simulation (quantitative) and observation (qualitative), was deemed important. Understanding the differences between the two is crucial for effective collaboration between architects and engineers.
3. **Knowledge, Skills, and Competences:** Participants suggested that the course should have learning objectives on knowledge, skill, and competence levels. Besides quantitative knowledge and skills, there should be an emphasis on understanding the context and factors affecting simulation quality.
4. **Gamification and Interaction:** The idea of gamification and interaction with simulation tools was well-received. Providing tools that allow students to interact with and experiment on daylight simulations was considered important for learning.
5. **City Planning and Urban Scale:** Participants stressed the significance of considering city planning and the urban scale in daylight design. Exterior context, building distances, shapes, material properties, and vegetation all play a crucial role in daylighting, and it is important to address these aspects in the course.
6. **Biophilic Design:** Suggestions were made to include topics related to biophilic design, where the connection between nature and daylighting is explored, along with the qualitative aspects of daylight, such as the view of the sky and nature.

In summary, the ultimate conclusions from the Danish workshops highlight the diverse motivations for daylight design, the importance of linking knowledge to regulations, the need for a holistic approach to daylight design, and the significance of city planning and urban considerations in the educational course. Additionally, incorporating gamification and interactive tools, as well as exploring biophilic design, could enhance the learning experience for students.

### 4.2. Italy

#### 4.2.1. Motivations

*Normative goals drive daylighting design*

The participants acknowledged and valued the importance of daylighting in architectural design, but they face challenges related to regulations and the need for educational efforts to convey its value to stakeholders, due to a limited knowledge on daylighting metrics and practice or to week daylighting standards. Integrating daylighting in the earliest design process was expressed as a best-practice goal to achieve, as this can play a significant role in achieving sustainability certifications and improving energy efficiency, as well as increasing the well-being of the occupants.

IT-11: "*purtroppo si riduce ad un rapporto che è 1/8, cioè io intervengo su progetti dove la luce naturale è ritenuta sufficiente se il rapporto dell'area delle finestre e l'area del pavimento è maggiore di 1/8. Quindi il mio approccio al daylighting design nella professione fondamentalmente è questo, scardinare il requisito dell'1/8, spiegare che cos'è l'FLD che è in assoluto il concetto più semplice da far capire, cioè la percentuale che ti dice quanta luce hai dentro in rapporto a quanta luce hai fuori, ed infine far entrare la daylight design fase nella progettazione già dalle fasi preliminari*".

IT-02: "*La mia impressione è che a livello normativo locale si faccia fatica a recepire le avanguardie del daylighting ma che anzi, si tenda a preoccupanti semplificazioni. È difficile prevedere quando, in Italia, davvero si riuscirà a implementare una progettazione avanzata del daylight e dell'illuminazione circadiana nella pratica professionale*".

IT-12: "*Per me è fondamentale il daylighting perché, detto in modo un po' grezzo, vale dei punti nei protocolli. Questo da un lato è negativo, perché si riduce un concetto molto ampio a un elenco di punti ma d'altra parte obbliga in qualche modo i progettisti e la committenza, che ha un interesse a ottenere una certificazione LEED per esempio, a una riflessione che altrimenti non farebbe, perché di solito si parla in maniera più diffusa di illuminazione artificiale mentre il daylighting si riduce ad una finestra dimensionata in modo approssimativo*".


In more detail, the following considerations can be drawn:

- **Daylighting is a significant consideration:** Daylighting is a crucial consideration in architectural and building design. It goes beyond aesthetics, impacting factors like energy efficiency, occupant comfort, and environmental sustainability.
  IT-02: "*La mia impressione è che a livello normativo locale, si faccia fatica a recepire le avanguardie del daylighting ma che anzi, si tenda a preoccupanti semplificazioni. È difficile prevedere quando, in Italia, davvero si riuscirà a implementare il daylight avanzato e circadiano nella pratica professionale*".


- **Challenges with regulatory adoption**: There seems to be a challenge in adopting advanced daylighting practices due to regulatory barriers. Local regulations often lag behind innovative daylighting solutions, making it difficult for professionals to implement cutting-edge daylighting techniques.
  IT-05: "F*inché non ci sarà qualche vincolo normativo nella progettazione di edifici (in contesto urbano) non ci sarà una domanda professionale che richieda una figura specializzata*".


- **Integration of natural and artificial light**: Professionals aim at working on integrating natural and artificial light sources to create comfortable and efficient indoor environments. This integration is vital for achieving both lighting quality and sustainability goals.
  IT-09: "*Anche nel campo professionale quotidianamente ci occupiamo molto della progettazione della luce naturale, dell'integrazione tra luce naturale e artificiale, del comfort in senso globale, valutandolo con degli strumenti e dei metodi che possano poi portare un punteggio utilizzando alcuni tipi di protocollo di certificazione ambientale sostenibile a seconda delle esigenze del cliente*"

- **Sustainability certifications**: Daylighting is a critical component of sustainability certifications like LEED. It plays a role in earning certification points and encouraging a more thoughtful approach to design and construction.
  IT-12: "*Il daylight entra nel mio lavoro come credito del LEED e mi occupo indirettamente di simulazioni perché il mio obiettivo è il risultato finale in termini di punti*".

- **Educational efforts**: Some professionals are actively involved in educating architects and clients about the significance of daylighting. This education is necessary because not all stakeholders may fully understand or appreciate the benefits of good daylighting.
  IT-18: "*L'influenza dell'involucro sul daylight e sull'abbagliamento sono di centrale interesse per me, nonché le strategie di controllo e i metodi di misura in campo. Oltre alla parte accademica, ho passato diversi anni nell'industria in UK come façade engineer in una consultancy molto conosciuta per l'utilizzo del vetro strutturale e in quegli anni ho anche fatto analisi del daylight per attività di consulenza. Ora cerco di trasferire quella conoscenza nei miei corsi*".

- **Early integration**: Integrating daylight design into the project from its early stages is emphasized. This approach helps ensure that daylighting is not treated as an afterthought and can be optimized for the specific project requirements.

*Gain goals*

The discussions reveal a growing interest in and recognition of the importance of daylighting in architectural and design projects. They also highlight the need for a structured approach and collaboration between professionals and manufacturers to enhance the integration of daylighting in architectural design.

In more detail, the following considerations can be drawn:

- **Growing emphasis on natural light design**: Many professionals express a growing interest in the design and utilization of natural light in architectural and design projects. This indicates a recognition of the significance of natural light in creating inviting and comfortable spaces.

- **Material and light interaction**: The interaction between materials and light is highlighted as a critical consideration to increase the value of a project. The choice of colours and finishings plays a substantial role in shaping the quality of natural light in a space, making it warm and welcoming or cold and uninviting.
  IT-03: "*saper scegliere il colore giusto o il tipo di finitura giusta cambia totalmente il risultato luminoso finale e può rendere l'ambiente orrendo o freddo o poco accogliente o, viceversa, quello stesso spazio può diventare accogliente come un abbraccio. E questa è una cosa che io ho imparato veramente in cantiere*".

- **Collaboration between manufacturers and professionals**: Professionals see the value in collaborating with manufacturers to create windows and glass components that meet the specific needs of architectural projects. This collaboration aims to align products more closely with the evolving demands of the industry.
  IT-10: "*La sensibilità sta crescendo, nel senso che siamo già alla seconda generazione di produttori e le nostre idee sono sempre più al passo con le richieste dei professionist ; credo che dialogare con il professionista per progettare in un modo concreto e più specifico il serramento e le parti vetrate sia un grande vantaggio che potremmo sfruttare*".

- **Cultural and methodological framework**: IT-14 is interested in establishing a cultural and methodological framework to help designers effectively control natural light in their projects. This indicates a desire for a structured approach to managing natural light in design, allowing designers to better achieve their objectives and design language.
  IT-14: "*Mi interessa capire come fa il progettista medio a tenere sotto controllo il fenomeno della luce naturale nei propri progetti avendo come riferimento i propri obiettivi, le proprie inclinazioni ed il proprio linguaggio. L'obiettivo è quindi la ricerca di una struttura di base, culturale e metodologica*".

*Hedonic goals*

The statements expressed by the participants showed a deep appreciation for daylighting in architecture, its impact on well-being, and efforts to educate and sensitize future professionals to its importance. Additionally, there was a focus on the artistic and expressive aspects of light, historical considerations, and its role in corporate strategies for quality architectural design.

In more detail, the following considerations can be drawn:

- **Passion for natural light in architecture:** Many of the speakers express a deep personal interest in the role of natural light in architectural design. They see it as a fundamental and integral aspect of their work.
  IT-03: "*Anche se mi occupo più di luce elettrica, o proprio per quello, la luce naturale per me è importantissima. E la co-protagonista nel mio lavoro*".

- **Educational efforts:** Educators and professionals in the field are dedicated to raising awareness and sensibilizing students and young professionals to the importance of natural light in design. They believe that this knowledge is valuable, even for those who may not specialize in lighting design but pursue careers in architecture, engineering, or construction.
  IT-06: "*Perché insegno luce naturale? il primo sforzo è cercare di sensibilizzare gli allievi, che non è detto prendano la strada del lighting ma che magari faranno gli architetti o gli ingegneri, alle tematiche dell'uso della luce naturale*".

- **Well-being and quality of life:** The concept of well-being is closely linked to natural light. It is seen as a source of comfort and an essential element for creating spaces that are welcoming and pleasant to inhabit.
  IT-15: "*La luce per me, che mi occupo da sempre di tecnologie bioclimatiche, è anche energia, per cui ho una visione di due tipi: naturalmente la prima che è quella più importante, è il concetto di benessere*".

- **Historical and expressive aspects**: Some professionals are interested in the historical use of natural light in defining architectural forms and volumes. They also focus on the expressive and artistic aspects of lighting, viewing it as a tool for creating visual and experiential effects.
  IT-16: "*una grande parte è stata dedicata all'analisi dell'uso storico della luce naturale, proprio come elemento di definizione sia della forma che dei volumi, e che è un mio interesse che continua a permanere*".

- **Corporate goals and convincing architects**: Some professionals and companies are dedicated to convincing architects to prioritize natural light in their designs. They believe that it is both a visceral and strategic element that can lead to the creation of high-quality spaces.
  IT-14: "*il nostro lavoro consiste nel convincere gli architetti che vale la pena, nelle scelte quotidiane che fanno, staccarsi da una prassi automatica, basata sulle abitudini, e cominciare a riflettere su*

23

*come creare spazi di qualità, usando la luce naturale, che è un elemento palese ed evidente. Per noi il rapporto con la luce naturale è allo stesso tempo viscerale e legato ad una storia da raccontare e a degli obiettivi strategici aziendali da perseguire*".

*Tools and workflow*

The experts in daylighting design rely on a variety of simulation software, and they emphasize their integration into the early stages of the design process; besides, they also acknowledge the complexity of defining parameters for simulating and achieving high daylighting quality. Collaboration between experts and a multisensory approach to design are critical aspects of their work.

IT-12: "*Quando mi coinvolgono fin dall'inizio nella progettazione ho la fortuna di poter dialogare con i progettisti e di poter chiedere loro che venga inserita un po' di illuminazione naturale anche se molto spesso quando mi coinvolgono è già tardi per intervenire. Per fortuna, ultimamente i progettisti sono piuttosto attenti, non tanto all'illuminazione naturale quanto alla vista verso l'esterno grazie alla quale arriva anche la luce naturale e quindi normalmente questo credito riusciamo ad ottenerlo*".

In more detail, the following considerations can be drawn:

- **Multisensory approach:** Design professionals emphasize a multisensory approach, considering the relationship between light, colour, and material textures in architectural design.

- **Use of simulation software:** Commonly used software includes Radiance, Relux, Envimet, EnergyPlus, and Grasshopper, which help assess and optimize daylighting conditions in buildings.

- **Complexity of parameters and metrics:** Defining parameters for evaluating lighting quality can be challenging, as numerical data must be balanced with qualitative aspects like visual comfort and glare prevention.
  IT-06: "*nella simulazione evo tenere conto di parametri più complessi, quindi è difficile sintetizzare dei parametri che consentano di valutare la qualità dell'ambiente. Il rischio dell'uso dei software è quello che se manca la giusta sensibilità, i semplici parametri sintetici, anche quelli basati sul climate-based daylight modelling CBDM, rischiano di essere delle armi a doppio taglio. Bisogna comunque conservare quella capacità di valutare la qualità dello scenario*".

- **Early integration:** Natural light design should be integrated early in the concept development stage, setting the foundation for the entire project.
  IT-09: "*Nella progettazione della luce naturale e, in modo migliore, se si tratta di una progettazione integrata che va dalla definizione della forma dell'edificio, all'involucro edilizio, alla scelta del componente trasparente, schermante, etc. noi usiamo strumenti di simulazione, per esempio Radiance, e progettiamo in integrazione occupandoci spesso anche degli impianti illuminotecnici. Noi partiamo integrando il daylighting fin dalla definizione del concept*".

- **Collaboration with architects:** Close collaboration between lighting professionals and architects is essential to achieve desired lighting outcomes.
  IT-12: "*Quando si ha la fortuna di sedersi fin dall'inizio al tavolo dei progettisti come consulente LEED, si riesce a ragionare anche sull'illuminazione naturale, il che significa garantire che entri la luce all'interno degli ambienti ma anche che non ci sia abbagliamento, cosa abbastanza semplice da ottenere seguendo determinate strade all'interno del protocollo, basta sostanzialmente pensare a mettere delle tende*".

24

- **Visual and physiological effects**: Some professionals use simulation tools not only to meet criteria but to create diverse lighting scenarios that stimulate architectural and physiological responses to light.
  IT-08: "*Il daylight per noi è un materiale quasi compositivo e non esagero nel dire che i nostri edifici nascono proprio da un'immagine di luce naturale e sono incentrati sul benessere delle persone che li vivono grazie al daylighting e alla vista verso i paesaggi esterni, sull'orientamento solare (quindi edifici passivi) e sull'energia zero*".

*Competences*

The participants in the conversation expressed enthusiasm and support for the educational program in daylighting design, acknowledging its value for both students (especially PhD students), academics, and professionals. They discussed the development of the curriculum, focusing on the importance of balancing theoretical and practical aspects, incorporating real case-studies as showcases of best and worst practice, and adopting a transversal approach that considers how natural lighting design fits within broader architectural and design contexts. The Summer School is seen as particularly valuable for hands-on, practical experience. Additionally, involving industry partners to provide real-world case studies and practical insights is considered essential to create a comprehensive and relevant learning experience. Overall, the discussion highlights the need to address educational challenges such as module structure, duration, and the integration of complex simulation-related topics to create a well-rounded and effective educational program.

IT-02: "*La tendenza oggi è richiedere espressamente edifici che garantiscano un certo livello di prestazione energetica, in termini di classificazione e di protocolli. E ciò mostra i limiti nella preparazione dei professionisti. Spero che NLITED possa aiutare in questo senso, perché questo tipo di formazione avviene nei master specializzati*".


In more detail, the following considerations can be drawn:


- **Enthusiasm and support:** The participants express enthusiasm and support for the educational program, highlighting its value for students, academics, and professionals.
  IT-05: "*per studenti di dottorato interessati al tema poter accedere a questo tipo di materiale, soprattutto in relazione ai moduli avanzati, sarebbe di sicuro un prezioso contributo, mentre la parte dove si trattano le conoscenze di base credo che potrebbe essere utile come formazione per professionisti che vogliono saperne di più senza diventare specializzati. Pensando ai laureati magistrali, essi avrebbero una preparazione di base già molto avanzata e magari potrebbero essere interessati direttamente alla Summer School*".

  IT-06: "*un progetto educativo centrato sull'uso della luce naturale in tutte le sue declinazioni è fondamentale perché è quello che manca nel panorama formativo che viene offerto soprattutto in un periodo in cui si punta molto all'efficienza energetica dell'edificio o al benessere inteso più come benessere termo-igrometrico e così via. Avere delle lezioni che mettano insieme il contributo dell'involucro edilizio e in particolare dell'involucro trasparente e dall'altra parte l'uso della luce, complessivamente è una cosa che tutti diciamo importante però che poi nessuno ha svolto*".

  IT-14: "*Si dovrebbe affrontare un lavoro in parallelo tra professionisti, ordini professionali, e studenti che saranno i professionisti di domani e che, se seguiranno un corso come questo, intraprendendo la libera professione e consegnando progetti agli uffici tecnici rimarranno sorpresi di vederli approvati solo perché hanno rispettato il calcolo del rapporto aero-illuminante, invece di diventare uno di questi nostri interlocutori che non mettono neanche il nord nelle piante e si dimenticano come sono orientate le case*".


- **Curriculum development:** the structure of the curriculum was discussed, including the organization of modules. Participants suggested including both theoretical and practical aspects of

25

daylighting design. They emphasized the importance of practical examples, case-studies, and the integration of real-world scenarios.

IT-05: "*è importante introdurre il daylighting nella pianificazione urbanistica, perché poi una volta che hai stabilito qual è la relazione tra spazi aperti e spazi occupati dagli edifici, che fondamentalmente si fa a livello di pianificazione, poi è difficile che quella relazione si modifichi nel tempo. I tessuti urbani, la larghezza delle strade, l'altezza media degli edifici, una volta che è decisa fondamentalmente quella è, e quello influisce molto sull'accesso alle risorse naturali, non solo luce, ma termiche, ventilazione. Inoltre, mi piacerebbe vedere un modulo che metta in relazione la progettazione della luce (ad esempio come strategia di design passivo in confronto ad altre strategie) in termini di pro e contro rispetto agli aspetti energetici. Le tematiche potrebbero essere: comfort estivo; progettazione delle aperture delle finestre; problemi invernali; caratteristiche specifiche delle diverse tipologie (uffici, residenziale, ecc.)*".

IT-11: "*la chiave è capire come riuscire a diffonderlo, […] per evitare che sia un percorso formativo che faranno solo quelli che sono già formati*".

IT-12: "*Io forse aggiungerei i protocolli di sostenibilità in generale, ad esempio il protocollo Itaca, i CAM e il protocollo WELL*".

- **Transversal approach:** Some participants propose a more transversal approach, aiming to understand how natural lighting design can fit within broader architectural and design considerations. This suggests the importance of interdisciplinary learning.
  IT-04: "*Una cosa vincente su cui bisogna puntare è la multidisciplinarietà, nel senso che noi qui abbiamo il tema del comfort delle persone (che riguarda la psicologia), abbiamo il punto di vista termico e poi siamo più o meno tutti esperti di illuminazione naturale, architetti, ingegneri*".

  IT-05: "*Il tema del daylighting mette insieme qualsiasi tipo di competenza, dai climatologi, ai geografi, ai pianificatori, agli urbanisti, agli architetti e quindi è interessante e complesso allo stesso tempo*".

  IT-04: "*Per ogni blocco si potrebbe fare un modulo semplificato di presentazione dedicato a chi vuole capire, avere un'infarinatura di quell'argomento trattato. Chi invece vuole scendere più nel dettaglio e ha già le basi può tranquillamente saltare, mentre chi invece vuole solamente avere dei primi rudimenti segue in modo agile*".

- **Summer school:** Participants view the Summer School as a valuable component of the program, particularly for hands-on, practical experience. The challenge here is addressing the time required for simulations during the Summer School, as it may limit coverage of other essential topics.
  IT-16: "*La Summer School è assolutamente utile, mi viene da dire che quasi la renderei obbligatoria, nel senso che a livello progettuale serve l'esperienza diretta, altrimenti il timore è che rimanga tutto a livello teorico*".

  IT-18: "*Si potrebbe anche pensare a metodi di flipped classroom in cui sono gli studenti a dover presentare qualcosa, per stimolare l'interazione e puntare non tanto solo sull'apprendimento della parte teorica. Questo è molto più facile da fare nella Summer School*".

- **Industry engagement:** There's a suggestion to involve industry partners in providing real-world case studies and practical insights.
  IT-14: "*è importante presentare dei case-studies, come examples of good design; quello è l'unico momento in cui in tutto il percorso formativo si parla di esempi di buona progettazione. Quello è il riferimento che rimane negli occhi*".

IT-11: "*occorre presentare una serie di worst-practices che si mettono in atto nel progetto della luce naturale, perché secondo me nella propria attività professionale, ci si riconosce molto di più negli errori che in casistiche estremamente virtuose*".

- **Educational challenges:** The need to balance theoretical and practical aspects, the duration and structure of modules, and the integration of complex simulation-related topics are challenges to address.
  IT-06: "*È importante che il fruitore del corso possa gestire le tempistiche e lo scaglionamento dei sub-moduli in modo tale da potere ragionarci su e risentirli*".

*Cultural issues*

There was a recognition of the need for practical applications that involve measurements within buildings to help students understand key quantitative metrics and connect them to quality aspects. However, there are challenges in providing this type of education to engineering students, as traditionally these topics are not extensively covered in engineering curricula. Furthermore, the discussion highlights differences in approaches between countries, such as the UK and Denmark, in terms of students' engagement with measurements and physical modelling. There's a consensus that enhancing practical experience and emphasizing measurement techniques in courses is crucial to improving students' understanding of daylighting and its role in the design process.

The most important points from the provided conversations include:

- **Lack of knowledge in daylighting**: there was a consensus on highlighting a general lack of knowledge among students and professionals on daylighting design, which includes metrics, standards, and technology for an advanced design process. This lack comes from a limited education on daylighting in both architecture and engineering curricula and in a gap between the academic and the professional worlds.
  IT-02: "*La conoscenza di studenti e professionisti è veramente molto bassa e si limita il più delle volte al fattore di luce diurnal se non al solo rapport aero-illuminante (il cosiddetto 'requisito 1/8'). Quest'ultimo parametro, infatti, predomina nei risultati per la praticità incontestabile. Finché non ci sarà una legge dello Stato italiano (così come è successo per la certificazione energetica), il tema della luce nella prestazione energetica e sulla salute dell'uomo rimarrà un virtuosismo*".
  IT-06: "*anche i docenti che si occupano di fisica dell'edificio e di benessere ambientale generalmente trascurano la parte legata all'illuminotecnica. Invece non c'è più niente ormai di definitivo, anche per quanto riguarda la stessa conoscenza del sistema visivo umano e del legame fra luce e ritmi circadiani, vengono fuori sempre cose nuove, quindi la cosa importante è essere ben aggiornati*".
  IT-09: "*mentre le prestazioni energetiche, il comfort termico e la classe energetica sono entrati nell'immaginario comune, quindi anche dei non tecnici, il valore della luce e di una corretta progettazione illuminotecnica, se non c'è l'attenzione e la sensibilità del progettista che se ne fa carico spiegandolo alla committenza, non è assimilato agli altri temi legati alla fisica classica dell'edificio*".
  IT-10: "*i professionisti quando arrivano da noi per fare la richiesta sull'intervento per i serramenti non chiedono mai la trasmittanza luminosa del vetro; chiedono il valore di risparmio energetico, a volte fanno qualche richiesta in merito ai diritti ministeriali sulla sicurezza passiva o sull'acustica, mai sulla trasmittanza luminosa del vetro*".
  IT-05: "*la progettazione del daylight sus cala urbana non viene affrontata, ci si concentra sugli edifice: ma questi edifici stanno in città e l'influenza del contesto urbano su tutto quello che riguarda la progettazione dell'edificio spesso viene a mio avviso sottovalutata nei percorsi formativi*".

IT-13: "*Durante la mia formazione nell'ambito della luce naturale mi sono accorto del ruolo che essa può giocare in termini di risparmio energetico e quindi ho sperato che questo potesse essere un buon modo per ampliare il campo su questo argomento. Devo dire che sono rimasto abbastanza deluso dalla reazione dei miei colleghi che hanno davvero scarsa attenzione a questi aspetti; e purtroppo mi sembra di aver notato lo stesso atteggiamento anche da parte degli studenti almeno alle mie latitudini, cosa peraltro poco ragionevole*".

- **Enhancing practical experience:** There is a recognized need for practical applications to real problems in the curriculum. These applications should involve field measurements within buildings or in scale models to help students understand key variables related to daylighting. This practical knowledge is seen as vital for students to gain a deeper understanding of natural lighting and its role in the design process.
  IT-17: "*Quello che abbiamo fatto a Copenhagen, che è proprio l'impostazione della Royal Danish Academy, era di partire dallo studio del daylighting in edifici reali e poi di lavorare soprattutto con modelli in scala e con una specie di Heliodon per il daylighting, per poi arrivare alla simulazione soltanto dopo. La cosa principale è sempre stata il controllo qualitativo della luce per passare poi al numerico.*"

- **Challenges for engineering students:** It's noted that there are challenges in incorporating these practical applications into engineering education, as traditionally, engineering curricula may not cover these topics comprehensively. This integration is considered important for producing well-rounded professionals.
  IT-18: "*Il problema che abbiamo noi è che agli ingegneri non insegniamo il daylighting, non riusciamo ad andare oltre il corso di fisica tecnica di base, quindi non c'è assolutamente nessuna esperienza. Questo si insegna solamente nei curricula di architettura. Similarmente, anche nella mia esperienza in UK era così*".

- **Geographical differences**: Participants highlighted differences in the educational approaches between countries, such as the UK and Denmark, where students are more engaged in measurements and physical modelling. This highlights the importance of sharing best practices and adapting teaching methods to the specific needs of different regions.
  IT-17: "*Una grossa differenza rispetto agli UK, ma anche rispetto alla Danimarca, è l'approccio degli studenti sulla misura e sui modelli fisici che ho visto all'estero e che noi in Italia riusciamo ad avere solo nelle tesi invece di sensibilizzare gli studenti durante un corso. Inoltre, un'altra cosa interessante riguarda alcune esercitazioni in cui si entra in alcuni edifici reali per fare delle misurazioni in modo che gli studenti possano conoscere le grandezze, ma anche abbinarci una certa qualità*".

Overall, the key takeaways revolve around the importance of practical experience and measurements in teaching daylighting, addressing challenges in integrating these topics into engineering curricula, and recognizing the need for adaptable teaching approaches in different geographical contexts.

*Take-aways from the Italian workshops*

The discussions surrounding daylighting in architectural design bring to light a multifaceted landscape of considerations, challenges, and aspirations. Daylighting is undeniably a significant factor, extending its influence beyond aesthetics to encompass critical elements such as energy efficiency, occupant comfort, and sustainability. However, a series of challenges, most notably outdated local regulations and the need for educational initiatives to convey its value, stand as barriers to realizing its full potential.

Professionals in the field emphasize the importance of integrating daylighting early in the design process, preventing it from being relegated to an afterthought. Furthermore, they acknowledge that a multidisciplinary and multisensory approach is necessary, considering the interplay of light, color, and materials.

The role of simulation software cannot be understated, with tools like Radiance, Relux, and EnergyPlus aiding in the assessment and optimization of natural light. Yet, there is a desire for more integrated software suites that streamline the design process. Professionals actively engage in educating stakeholders about daylighting's significance, recognizing that not all parties grasp its full scope.

The educational aspect emerges as a key theme, and there is a growing emphasis on natural light design. Here, discussions focus on the development of a curriculum that balances theoretical and practical components, incorporates real-world case studies, and follows a transversal approach that integrates daylighting into the broader architectural context.

Practical exercises are deemed essential, helping students comprehend key variables and connecting them to quality aspects. However, incorporating these exercises into engineering programs presents challenges, particularly due to traditional curricula.

The differences between countries, such as the UK and Denmark, underscore the need for adaptable teaching methods that cater to the specific needs of different regions. Achieving a comprehensive education in natural lighting design hinges on industry involvement, providing practical insights through real-world case studies.

In essence, these conversations demonstrate a deep appreciation for daylight in architecture, recognizing its impact on well-being and design quality. They underline the importance of overcoming regulatory barriers, enhancing educational efforts, and embracing a holistic approach to lighting design to create spaces that are not only aesthetically pleasing but also sustainable, comfortable, and enriching for occupants. It's an interdisciplinary journey that seeks to balance artistic expression with scientific precision and a shared commitment to producing well-rounded professionals equipped to navigate the complexities of daylighting in architectural design.

## 4.3. Poland

The Polish results highlight the motivations of professionals in daylighting design, the need for better education and community involvement, preferences for course structure, and the focus on specific topics of interest to professionals in the field.

### 4.3.1. Motivations

- Professionals primarily design for daylighting compliance with standards and regulations.
- Normative documents, such as building energy regulations and certifications, are a key driver.
- Daylighting can contribute to sustainability goals, which may attract customers and boost sales.
- Some professionals view daylighting as a commercial opportunity, both for energy savings and increased sales.
- Many professionals value non-visual effects of light but find it challenging to integrate them into the design process.
- Some professionals are motivated by a mission to improve people's health and well-being through daylighting design.

### 4.3.2. Beyond Specialist Daylighting Education

- Professionals believe students should be actively involved in the training process, with inspiration incorporated into lectures.
- Feeling part of a community of learners is essential to keep students engaged.
- Professionals in other fields, like urban planning, should have a basic understanding of daylighting to influence decisions.

### 4.3.3. Topics and Structure:

- Professionals prefer inspirational material over dry information on compliance with legislation.
- Self-paced courses are desirable as they can be taken during free time.
- Courses should offer both general knowledge and practical applications for architectural design.
- A holistic curriculum balancing simulation and field observations is suggested.
- Flexibility in choosing topics is important to suit individual needs.

### 4.3.4. Preferred Topics:

- Demand for more in-depth knowledge on daylighting topics.
- Introduction courses are favoured over advanced ones.
- Interest is particularly high in topics related to environmental quality, occupant comfort, and design culture.
- Specialized modules, such as BSDF data and circadian daylighting design, are less popular, indicating a need for prior knowledge in daylighting education.

## 4.4. Sweden

### 4.4.1. Motivations

The question "why do you design for daylighting?" prompted long discussions among the participants. Although daylighting design seems to be driven by normative goals, the discussion suggested that gain goals (e.g., placing the company in a ground-breaking position in terms of daylighting design) and hedonic goals (e.g., feeling to have a mission for a better society) are also important for many of the participants. More than one goal seems to be activated at the same time. For example, some participants developed their own early design tools for their clients. The tools allow for easier and more rational work by the participants (gain goal), which simplifies the procedure for compliance to norms (normative goal).

The motivations are explored in more detail in the next paragraphs.

*Normative goals drive daylighting design*
Most participants at the workshop were practitioners working for architectural, engineering, or consultancy companies. According to all of them, daylighting design is performed almost entirely for compliance with norms which are in the form of the building regulation's energy requirements, building certifications as well as company policies. Depending on the company, the compliance would differ. For practitioners working in a company which have not a structured daylighting design department, compliance means reaching the requirements of the Swedish Building Regulation (BBR), namely a point Daylight Factor. Companies that have a more developed daylighting design department are more likely to engage in LEED and BREEAM certification. In this case, compliance meant also reaching benchmark values of e.g., Spatial Daylight Autonomy (sDA) or the like. In such cases, the practitioners were more familiar with climate-based daylight modelling (CBDM) and they could offer more advanced services to clients, but they also claimed that reaching the LEED or BREEAM certification was the main – when not the only – scope of their CBDM analysis.

SE-10 24:30: "*The first thing that we do is just to apply for a standard. Like most of the time, like 90 percent of the time. It is BBR fulfilled? Or, sometimes, LEED, BREEAM? Like it happens, but uh, it rarely happens*".

As norms are driving daylighting design, it appears that better norms are the only way to get better buildings. One of the participants was particularly hopeful in this sense, seeing in the new European Standard 17037 a way forward.

SE-04 20:50: "*over the past couple of years, we've started to move only from sort of legislated minimum of daylight factor. Now we're starting to deal with. Better metrics and in particular DGP, and having the European standard make a methodology for that has helped quite a bit*"

The above comments reveal almost a sense of frustration of the participant. Like many others, this participant recognized that normative goals are the driver in practice, but she/he felt that the daylighting specialist as a more important mission, dealing with better buildings for a better future. In other terms, a hedonic goal which is associated with the normative goals.

SE-03 17:05: "*I would like to say for the love of architecture, but more practically it is because we have regulations and certifications to fulfil*"

SE-02 21:40: "*I actually agree very much with people talking before me. Personally, I see it as a value added to architecture in terms of quality and wellbeing of the users. But unfortunately in the practical experience is a lot about reaching the standards.*"

SE-13 25:30: "*Yeah, it is what we want to do is something completely different, but to what we're doing, that's sad.*"

In many other cases, gain goals are pursued together with the normative ones. Participants claimed that architectural drawings end up on their table when there is already little space for improvement by the daylight specialist. This because urban planners and architects have already defined volumes and openings, sometimes the rooms have been already drawn, etc. The work of the daylight specialist becomes complicated and limited to few possible solutions, even if it is just about compliance to standards. The main issue here is that professionals without a daylighting design background are responsible of decisions and therefore, has a huge impact on daylighting design. As a solution, participants from two companies developed their own early design tools. The tools provide a fast calculation of basic daylight performance metrics, like Vertical Sky Component VSC, or Daylight Factor DF in the space depth, yearly shadows, etc. As a service, the companies provide the tools to those responsible of shaping volumes and openings, who can play with volume and provide models that have easier compliance with standards. At that point, the daylight specialist can provide a fine tuning of the design and the final advanced simulations.

SE-12 53:50: "*We work in four phases. The first phase we work with VSC and during the massing studies on the second phase we give information when they are going to start to design the interior layout we give information about the maximum depth that they can have considering relatively large windows and relatively light glass. So they know like what's absolute maximum depth that they can have in different parts of their building so that we don't have surprises later on in the process. And then when they're done with the interior layer and let's start with the facade, we give that information over the minimum window size that they need a bit everywhere. During later stages there's always different consultants come into the project and they have to change a lot of things. So we just with that and this is when they are working in Revit then not anymore in Rhino. So by then we are trying to do something like what SE-10 presented. We try to link Revit to Rhino*".

In such cases, a hedonic goal – having easier life when it is time for the final daylighting design – motivates professionals to develop tools which are aimed, at the end, to compliance with standard (normative goal).

Because hedonic and gain goals are intrinsically activated in the participants, some comments showed that they are used to lobby on legislators. In practice, the participants are used to ask for better regulations as they will drive more advanced daylighting design. The participants would benefit of more advanced daylighting design as a requirement as this is still a niche competence (gain goal) and because they believe that well daylit buildings are important for society.

SE-08 27:30: "*And this very very hard densification is even pushed by municipalities sometimes, and this is something I hope it will be changed in the future, we are still struggling with it. We need to inform all the lawmakers and politicians and whatever.*"

*Daylighting beyond norms*

For the participants who did not work daily with daylighting design, the value of daylight was different. The motivation driving daylighting design were more oriented towards gain goals.

A participant from the retail sector claimed very clearly that daylighting is used in the company project because it can increase sales, while saving energy.

SE-17 37:40: "*We were also saying that daylight is a commercial opportunity, so we are also taking it once more, not only for the yeah energy.*" SE-16 continues "*Yeah, it has been shown that people buy more if they are running around in the store with daylight.*"

But also, for achieving sustainability goals of the company, which are not normative goals in a strict sense, but they help in placing the company on a better spot in relation to the customers.

SE-17 30:30: "*We started to look into a more sustainable about 10 years ago. And we looked from two different angles: we actually looked it from an engineering point of view, seeing the energy consumption in the building in itself, and also from the soft values. So to say, added social and things like that. And when we summarized everything, we could see that actually daylight is one of the biggest contributor to be more sustainable*"

The vision of the participants and his/her company is to utilize daylight so far.

Another participant from a public agency responsible for the work environment was keen on promoting the benefits of daylighting in terms of improved conditions for workers.

SE-16 54:30: "*For the Swedish Work Environment Authority the circadian rhythm, etc is one of the main reasons why we require daylight because during daytime, if you have a higher vigilance, you're increasing the degree of awakening. You feel better, but you also reduce the risk for accidents. And if you're well. The enough exposed to daylight during daytime you will. Be able to produce more melatonin during night time and you'll have a better sleep and you have all your gear 24 hour. Rhythm is synchronized in a much better way, so we do push for these circadian rhythm effects that you get by daylight exposure at work.*"

SE-16 56:30: "*I could add that the we don't accept what's called daylight light sources. There are no true daylight. Light sources. So there should be daylight and the explanation that we give in our information is that daylight is so much more than just the light daylight itself. The change in color temperature and color rendering during the day. The difference between morning and lunchtime and afternoon. Brings in information for the body to that that synchronizes the body and also the the angle in which the daylight folds into your room and your your work site is also is an input for the for the 24 hour rhythm*"

The same participant claimed that the agency has been working on these aspects by making daylighting as requirement (normative) and checking that they are complied with

SE-16 34:30: "*I would recommend that that you bring in daylight also where they work, not only in the in the locations where they have their pauses and launch areas there. If possible they should have it also where they perform their work. Yeah, and this is based on the EU directive on the workplace design. [...] When our [...] find that there is a lack of daylight, we can put demand that daylight shall be introduced if possible. And there has been a lot of inflamed controversies with employers where we have put a demand that you must bring in daylight here. We could have forced them. I think in all cases to either bring in daylight or move their business to a work site where there is daylight available.*"

As imposing daylight is sometimes critical, the participant claimed that other arguments are used:

SE-16 37:20: "*An easy reason to say that you must have daylight, but we can also persuade employers that daylight will also have a possible effect on their production.*"

Even for the other participants daylighting goes well beyond vision and requirements. Parts of the discussion moved towards non-visual effect of light and circadian rhythms. Most of the participants agreed that this was an aspect of terrific importance for the profession, but it is not yet considered in actual project. For example, beside one participant having worked with several WELL certified

buildings, the others were involved only occasionally in projects where circadian aspects were included. The situation was perfectly summarised by participant SE-04:

SE-04 50:00: "*Well, I put it this way. If I open my door tomorrow and there's a platypus sitting on my front step, I may be less surprised by that than some client coming to me and saying we want you to do melanopic lux.*"

*A mission to be accomplished*

Some of the participants believes that well designed daylighting spaces are very important for the well-being of occupants. Beyond norms and beyond professionals or individual gains, these participants felt an intrinsic pleasure to work for a better daylit future.

SE-19 16:50: "*I do that in order to improve to health of people, that's my driving force.*"

SE-10 24:30: "*Sometime what we want to do is to create a good space like to get enough daylight for, yeah other than the standards as they are forced to do*"

SE-12 36:50: "*10% where we work on more qualitative things or more advanced. Metrics, or more advanced simulations that I that's a part that I think we should especially should, should take care of.*"

SE-04 30:40: "*I'm a little bit hopeful it, especially as again, I talked with. The younger people seem to be a lot more connected in terms of environment and health and well being. I look fairly positive at the outlook going forward for conscious daylight design.*"

### 4.4.2. Definition of competences and practicalities

The answer to the three topics "Definition of competences (eModules)", "eLearning – practicalities", and "Summer school" revealed three macro themes: understanding needs, keeping engaged, and sense of community.

*Understanding needs*

Regarding the needs, the findings were pretty much in line with literature. The course seems important for the professional development of the participants, as it would help their companies enter a growing segment of the market. The idea of having a mix-and-match approach for the modules was very much appreciated, as the interviewed professionals had already experience with some of the content that is offered. "*It helps saving time and focus only in filling the gaps we have*", one said. The time issue was mentioned constantly, and all the interviewees asked for a self-paced course since this type of course is taken beside the professional activity, during free time. The modules providing general information on daylight design and its applications in architectural design and engineering, and the flexibility to choose from the various modules to suit individual needs and desires were also mentioned.

Interestingly enough, the participants asked for modules mixing both practical notions (like metrics and how to calculate them) with inspirational lectures or case-studies. Most of them claimed that such courses should be easy to follow and inspiring, since they would join it during evenings or weekends.

Another interesting aspect is that Swedish professionals do not see a certificate of completion as a trigger to join this course. This contrast with literature (Kwan *et al.*, 2009; Luik *et al.*, 2020) and with the findings we are collecting right now in "clone" workshops held in other countries. It is believed that this has to do with different requirements in the professional world. According to a study, own interest is often more important than certification (Liu *et al.*, 2020).

Having a self-paced module taken during evenings comes with a risk of dropping out. Thus, many professionals had the desire to breakdown the modules in smaller parts with small assignments and deadlines. One of the interviewed proposed peer-review as a powerful method to keep engaged, learn more and get inspired; all the others agreed.

Finally, an architect with few years of experience in higher education stated that "*there is a risk that your modules provide knowledge, but we need skills*". The observation was of particular interest for the whole NLITED project; therefore, it was discussed how to tackle this issue. Some reflections are reported in the following sections.

Together with the project groups and the professionals attending the workshops, the moderators reflected on the issue of keeping engaged and developing skills. While inspirational parts of the lecture as suggested above, e.g., a documentary/podcast/reading/case studies, are certainly good to keep students interested, this may not always help developing skills. It was understood that a more active participation of students was necessary from time to time. From literature, seems that gamification is a powerful instrument in that sense, especially for the case of MOOCs (De Notaris *et al.*, 2021). Gamification has been also successfully employed in MOOCs dealing with energy topics (Rincón-Flores, Mena and Montoya, 2020). For the specific topic on NLITED – daylight design of buildings and energy use -, learning by playing as been successfully used, but only in a classical classroom setting (Reinhart *et al.*, 2012).

Therefore, the NLITED groups thought to a cloud-based collaborative design of a building. Although technically possible, this would have been difficult with a self-paced course. In addition, this could be relevant only for modules dealing with daylighting design simulations, but not for modules that are more theoretical. The Danish partner provided a first draft of an interactive interface consisting of "surrogate daylight model" with pre-loaded simulations, see the example at https://youtu.be/4YAs3R3vcUE. The student receives a pre-modelled room and can change autonomously window sizes, the colour of surfaces, geographical location etc. and, in real-time, they can see how different daylight metrics are affected; energy use can also be included in the model (because of overheating, for example). One can also set a target value for a metric and see which combinations of geometry/material would achieve that target. The student does not need any pre-knowledge in simulation; it is just about playing with the different bars. The interface is entertaining, and it has the huge advantage of being suitable for all the modules in the course, even the theoretical ones. For example, when discussing the history of daylight architecture, a student could use the interface to see how placing an *ashrabiya* (oriel window in carved wood from Arab architecture) project shadow indoor and reduces overheating. We believe that this tool, on top of keeping engaged, can help develop skills, or, at least, give a practical sense of how different designs affect daylight.

*Sense of community*

The interviewed professionals believe that it is important to feel part of a community of learners, and this is known in literature (Brown, 2001; McInnerney and Roberts, 2004). In the project, we planned for extensive use of digital collaborative tools to perform group work, but this will not be always possible. Therefore, we targeted the issue of a sense of community already at the project application stage, where we included a summer school at the end of the course. The input for the workshops helped shaping this summer school. The totality of professionals believed that the summer school should include study visits and hands-on session. Those must be clearly linked to specific modules/lectures. All the professionals had memories of some kind of lab experience from their education and they believed that this is by far the best way to acquire skills over knowledge.

In addition, a couple of professionals were keen in highlighting the professional advantages of these social events. One mentioned that a learner needs a boot camp, where all stay, visit interesting buildings, have fun together speaking daylight, and meet inspiring and eminent personalities in the field. It is expected that friendship ties and they become ultimately a community, rather than machines with some competences.

### 4.4.3. Key takeaways from the Swedish workshops

The key takeaways, which will shape the final educational offer of NLITED, are listed as bullet points:

- **Make education accessible to non-daylight specialists**. The decision of some "non-daylighting" professionals, like urban planners and architects, have huge impact on daylight design. It is important to provide them with a basic understanding of daylighting and its relevant issues (e.g., energy savings, thermal comfort, view, human well-being etc.). The course should not aim only at educating daylighting specialist, but also promoting daylighting to a wider audience.

- **Be inspiring**. Even the daylighting specialists should be provided with inspirational learning material. This was seen through topics of daylighting in the history of architecture as well as museum lighting highlighted by some workshop participants.
- **Teach skills**. The pedagogical aspects of NLITED needs to develop skills on top of knowledge, possibly with hands on session, case studies, practical example, interactive interfaces.
- **Create a critical mass**. It is fundamental to create a network of daylighting professionals and daylighting enthusiast that recognizes them in a community of stakeholders.
- **Make a difference**. This community of stakeholders should demand for a change in norms, which is, ultimately, what will trigger a change towards better future daylit buildings.

## 4.5. Aggregated results

Here are the final conclusions from the texts provided for Denmark, Italy, Poland, and Sweden:

**Denmark:**

The Danish workshops underscore the diverse motivations for daylight design, including regulatory compliance, job satisfaction, commercial objectives, client demands, and a holistic approach. The educational course should focus on linking knowledge to regulations, striking a balance between simulation and observation, fostering a wide range of competences, promoting gamification and interaction, considering urban contexts, and exploring biophilic design.

**Italy:**

The Italian workshops highlight the significance of daylighting in architectural design, not only for aesthetics but also for energy efficiency, occupant comfort, and sustainability. Challenges include outdated regulations and the need to educate stakeholders. Integrating daylighting early in the design process is essential, as is a multidisciplinary approach. Professionals emphasize the role of simulation software and the need for integrated tools. They also underline the importance of practical exercises and an adaptable curriculum.

**Poland:**

The Polish results emphasize motivations for daylighting design, including compliance with regulations, sustainability goals, commercial opportunities, and health and well-being. Education should involve students actively and create a sense of community. A holistic curriculum with flexible topics is preferred, focusing on environmental quality, occupant comfort, and design culture.

**Sweden**:

Key takeaways from the Swedish workshops inform the final educational offer of NLITED. These takeaways emphasize the need to make education accessible to non-specialists, provide inspiration for all students, teach practical skills, create a network of daylighting professionals, and promote a demand for change in norms. The goal is to trigger a change towards better daylit buildings.

These conclusions reflect the key findings and recommendations from each of the workshops in Denmark, Italy, Poland, and Sweden, providing insights into the motivations, challenges, and aspirations in daylight design and education.

## 5. Conclusion

**Motivations**

Most professionals reported that daylighting design is performed almost entirely in compliance with standards and norms ('normative goals'). The normative documents are in the form of building energy regulations, building certifications as well as company policies: "The first thing that we do is just to apply for a standard. Most of the time, like 90% of the time. Is BBR [Swedish building regulation, a.n.] fulfilled? Or, sometimes, LEED, BREEAM? It happens, but it rarely happens". In other terms, legislation is the driver, even though this was sometimes reported in a disappointed manner: "What we do with daylight is mainly proving that the regulation is fulfilled. Unfortunately, that is mainly by this local rule we have in Denmark with the 10% (glass area to floor area). Because we developed a very quick method to do that, so we just use our spreadsheet". Daylighting can also help achieve the sustainability goals of the company, which are not normative in a strict sense. However, they are considered to place the company in a better spot regarding customers ('gain goals'):

"*When we have the chance, and that is when the building program sets higher demands, we work integrated, so daylight, solar heating, energy consumption together and then we can get much better results. Nevertheless, that is when clients put these demands*". For some participants, daylighting is used in the projects because it can increase sales while saving energy: "*Daylight is a commercial opportunity, so we are also taking it once more, not only for the energy.*" "*It has been shown that people buy more if they are running around in the store with daylight*".

For many participants, daylighting goes well beyond vision and requirements, towards non-visual effects of light. Most of the participants agreed that this is an aspect of terrific importance for the profession but not yet considered in the actual design process:

"*Well, I put it this way. If I open my door tomorrow and there is a platypus sitting on my front step, I may be less surprised by that than some client coming to me and saying, we want you to do melanopic lux*".

As for 'hedonic goals', quite a few professionals stated that they consider daylight design as "*a mission*". They feel committed to proposing daylighting design beyond regulations to their clients, having the well-being of buildings occupants in mind: "*I do it to improve people's health. That's my driving force*". Beyond norms and professionals or individual gains, these participants feel an intrinsic pleasure to work for a more and better- daylit future: "*We take the output from the rendering, the different sections, light, whatever, and then we work in Photoshop. So that is the creative part, where we get away from what is physically correct. Alternatively, we get further away from the simulation part and more into the interpretation. Your imagination of what it would be. It is much more about the atmosphere to convey what would it be like to be in this room. So, it is a bit, you can call it artistic interpretation, but we see it as an important tool, and trying to create spaces with light, scenarios, comfortable rooms*".

*Beyond specialist daylighting education*

Different considerations emerged during the workshops about the need to provide specialistic knowledge and actively involve students in the training process. Adding some inspirational parts to lectures (for instance, through case studies) can encourage the active participation of the students and thus increase their motivation. The interviewed professionals also pointed out the importance of feeling part of a community of learners to keep engaged, which is a crucial challenge in the eLearning process. Professionals recognized that other professional figures not directly involved in daylighting design need a basic understanding of daylighting because those are involved in the decisional process. Urban planners, for example, should be provided with essential daylighting tools and understanding, as their decisions have a considerable impact on daylighting in buildings.

*Topics and structure*

Despite having little time to follow educational courses, the professionals asked for more inspirational material, rather than only direct and dry information on how to design for compliance to legislation. All the workshops' participants asked for self-paced courses since these can be taken during free time.

Other issues mentioned were the need for courses that provide general knowledge and practical applications in the architectural design process and the flexibility to choose from the various topics to best suit individual needs. Some professionals argued that it would be helpful to propose a curriculum with a holistic view of daylighting design. That would balance simulation and field observations to overcome the stereotypes of *"an engineer working more in-depth with simulations (quantitative approach) and an architect working more in-depth with observations (qualitative approach)."*

*Preferred topics*

From the analysis of the results, we found a demand for more in-depth knowledge on the topics of daylight and daylighting. The educational project NLITED was well-received by all stakeholders involved, and the same applied to the online survey.

Participants have highlighted the need to go beyond merely national knowledge in all four countries, but the results show a greater desire for introductory courses. Moreover, this is confirmed by the first data on users who signed into the platform, which is now online: introductory courses are being more attended than the advanced ones.

From the ranking of the most voted topics in the surveys, users seem mostly interested not in the simulative parts, but in topics linked to environmental quality, occupant comfort and design culture (more than 80% of respondent). The reason could be that there are fewer courses on design and environmental comfort than on simulation and design aspects.

On the contrary, the most specialized modules were the least voted (≈50% of respondent), including the ones on new knowledge (BSDF data or circadian daylighting design) and detailed modules (modelling devices). It supports the idea that there is a need for a curriculum that can educate from prior knowledge about daylight.

## Ultimate Conclusion from the workshops

The discussions on daylight design workshops from multiple countries reveal a comprehensive set of key takeaways that emphasize the evolution and improvement of daylighting in architectural practice and education. While these takeaways were derived from different geographical contexts, they collectively present overarching trends and recommendations.

**Motivations for Daylight Design:**

Professionals across different regions are motivated by various factors, including regulatory compliance (normative goals), the development of tools for enhanced simulations (hedonic goals), economic gains for companies (gain goals), client-driven demands, and a holistic approach that values both qualitative and quantitative aspects of daylight.

**Educational Aspects:**

Education in daylight design is central, with an emphasis on practical and theoretical components. A balanced approach between quantitative knowledge and qualitative observations is recommended. The introduction of gamification and interactive tools is encouraged to enhance learning. Flexibility in course topics and adaptability to regional needs are considered important.

**Challenges and Barriers:**

Challenges persist, such as outdated regulations and the need to convey the value of daylighting to stakeholders. Integrating daylighting early in the design process and adopting a multidisciplinary approach that includes light, color, and materials are acknowledged as effective strategies.

**Simulation Software:**

Simulation software tools play a crucial role in daylight assessment, with a desire for more integrated software suites that streamline the design process.

**Community and Collaboration:**

Creating a network of daylighting professionals and enthusiasts is fundamental to promote knowledge-sharing and collaboration among students and professionals. Engaging stakeholders from various fields, including urban planning, is essential.

**Urban and Green Design:**

A growing interest in topics related to urban design highlights the importance of exploring the connection between nature and daylighting and appreciating qualitative aspects such as sky and nature views. Daylighting in urban context is also considered an area of great interest that needs better investigation.

**Overcoming Regulatory Barriers:**

Across regions, the need to overcome regulatory barriers, whether in building compliance or urban planning, is a common theme.

In conclusion, these cross-over workshops underscore the multifaceted nature of daylighting in architectural design and education. They highlight the significance of addressing motivations, overcoming educational challenges, emphasizing the role of simulation software, building a strong community, integrating biophilic design, and tackling regulatory barriers to create well-rounded professionals capable of navigating the complexities of daylighting in architectural design.

All this valuable information was collected and incorporated for the creation of the NLITED project's training offer.

## 6. References

- Brown, R. E. (2001) 'The process of community-building in distance learning classes', Journal of Asynchronous Learning Network, 5(2). doi: 10.24059/olj.v5i2.1876.
- De Notaris, D. et al. (2021) 'How to play a MOOC: Practices and simulation', Entertainment Computing. Elsevier B.V., 37. doi: 10.1016/j.entcom.2020.100395.
- Dubois, M.-C., Bisegna, F., Gentile, N., Knoop, M., Matusiak, B., Osterhaus, W., & Tetri, E. (2015). Retrofitting the Electric Lighting and Daylighting Systems to Reduce Energy Use in Buildings: A Literature Review. Energy Research Journal, 6(1), 25–41.
- Galasiu, A. D., & Reinhart, C. F. (2008). Current daylighting design practice: a survey. Building Research & Information, 36(2), 159–174.
- Galasiu, A. D., & Veitch, J. a. (2006). Occupant preferences and satisfaction with the luminous environment and control systems in daylit offices: a literature review. Energy and Buildings, 38(7), 728–742.
- Giuliani, F., Sokol, N., Viula, R., Lo Verso, V. R. M., Coch, H., & Caffaro, F. (2017). First outcomes of an investigation about daylighting knowledge and education in Europe. In LUX EUROPA 2017 - European Lighting Conference. Ljubljana, Slovenia, September 18-20, 2017.
- Kwan, R. et al. (2009) 'Blended teaching and learning in the School of Science and Technology of UniSIM', Interactive Technology and Smart Education. Emerald Group Publishing Limited, 6(4), pp. 234–243. doi: 10.1108/174156509110092 09.
- Lindenberg, S. and Steg, L. (2007) 'Normative, gain and hedonic goal frames guiding environmental behavior', Journal of Social Issues. doi: 10.1111/j.1540-4560.2007.00499.x.
- Lindenberg, S. and Steg, L. (2013) 'Goal-framing theory and norm-guided environmental behavior', in Encouraging Sustainable Behavior: Psychology and the Environment. doi: 10.4324/9780203141182.
- Liu, M. et al. (2020) 'What do participants think of today's MOOCs: an updated look at the benefits and challenges of MOOCs designed for working professionals', Journal of Computing in Higher Education. Springer, 32(2), pp. 307–329. doi: 10.1007/s12528-019-09234-x.
- Luik, P. et al. (2020) 'Programming MOOCs – different learners and different motivation', International Journal of Lifelong Education. Routledge, 39(3), pp. 305–318. doi: 10.1080/02601370.2020.1780329.
- McInnerney, J. M. and Roberts, T. S. (2004) 'Online learning: Social interaction and the creation of a sense of community', Educational Technology and Society. International Forum of Educational Technology and Society, pp. 73–81.
- Reinhart, C. F. et al. (2012) 'Learning by playing - teaching energy simulation as a game', Journal of Building Performance Simulation, 5(6), pp. 359–368. doi: 10.1080/19401493.2011.619668.
- Rincón-Flores, E. G., Mena, J. and Montoya, M. S. R. (2020) 'Gamification: a new key for enhancing engagement in MOOCs on energy?', International Journal on Interactive Design and Manufacturing. Springer-Verlag Italia s.r.l., 14(4), pp. 1379–1393. doi: 10.1007/s12008-020-00701-9.

# Annex A

## Annex A.1 – First mailing

**To be sent 1 month before the first workshop**

**Text to be adapted:**

Dear [*name*],

I am [name], from [name] University, and I am writing you on behalf of the NLITED team. NLITED is an Erasmus+ project aiming at creating a modular online course on daylight design of building (www.enlited.eu). You and your company supported us with the project application and we are delighted to say that the project has been approved. Thank you!

Now you have the chance to shape the course and influence its content. The course is thought for both traditional students and lifelong learners.

We have planned a workshop where we very briefly present NLITED and then we focus on the importance of daylight design in your work and the educational needs you have in your team or you see in the daily practice. The workshop will include max five [Danish/Italian/Polish/Swedish] professionals like you. It is estimated that it will take between an hour and a half and it will be held via the digital tool Zoom.

We prepared a short draft curriculum for the course, you will receive it about a week before the workshop. In our workshop, we will discuss mainly around that document. Give a look to that beforehand and try to think to what would be relevant, what irrelevant, and what competences are missing in today's professional arena.

Through your participation in the workshop, you will be able to make NLITED relevant for your team. Participation to the workshop is voluntary and you can leave whenever you want. The workshop is recorded and the answers will then be used in the context of NLITED project. The recorded video will be anonymized and data stored at [name] University.

The optimal is if you can be 1-2 people so I hope you can spread the invitation further to any interested colleagues. Registration is done via (Doodle).

Thanks in advance,
Mandana S. Khanie (DTU, Denmark)
Federica Giuliani (Unicusano, Italy)
Natalia Sokół (Gdańsk University of Technology, Poland)
Niko Gentile (Lund University, Sweden)
Pimkamol Mattsson (Lund University, Sweden)

Annex A.2 – Second mailing

**To be sent 1 week before the workshop where the partner has booked himself/herself**

**Text to be adapted:**

Dear participant,

I would like to remind you about our online workshop concerning the Erasmus+ project NLITED, [date] 2021 13:00 – 14:30, link [link]

Agenda
- Brief round table presentations
- Presentation of NLITED
- Your view on daylight design in current practice
- Discussion on the draft of NLITED curriculum (attached to this mail)
- eLearning, practicalities
- Short conclusive survey

I would also like to remind that participation to the workshop is voluntary, and you can leave whenever you want. The workshop is recorded and the answers will then be used in the context of NLITED project. The recorded audio will be anonymized and data stored at [name] University.

Thanks in advance,
Mandana S. Khanie (DTU, Denmark)
*on behalf of*
Federica Giuliani (UniCusano, Italy)
Natalia Sokół (Gdańsk University of Technology, Poland)
Niko Gentile (Lund University, Sweden)
Pimkamol Mattsson (Lund University, Sweden)

## Annex A.3 – Draft curriculum

First structure of the ePlatform curriculum added to the email in Annex 2 (second email).