



2.4: Methodological framework

WP2, Task 2.4

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Abbreviations and acronyms

Acronym	Description
EU	European Union
ESCO	Energy Service Company
LCA	Lifecycle analysis
nZEB	nearly Zero Energy Buildings
RES	Renewable Energy Sources
WP	Work Package
CBL	Challenge based learning
PBL	Problem based learning
IRL	In real life
ECTS	European Credit Transfer System



Executive summary

The nZEBRA project aims to create a blended learning adapted to modern learning patterns, and targets two groups: master students and professionals in need of upskilling their knowledge with climate neutral nearly zero energy buildings. The contribution of this deliverable is to compile the methodological framework as it has been developed in WP 2. No references from the previous reports are listed in this report.

Analytical report on target groups' learning needs and preferences, identified the main learning objectives and set guidelines for the nZEBRA course content using quantitative as well as qualitative methods. A global overview of the results indicates that the course should be multidisciplinary offering a wide and holistic view of climate neutral buildings. 3OC and HEPESCO carried out this task. The preferred format of the course was practical training with hands-on sessions, but overall, the most adapted form of training were a mix of in-person training and virtual materials.

Pedagogical approach and course syllabus, outlines the didactical views, pedagogical and methodological frameworks, learning methods and outcomes, and a course syllabus on climate neutral buildings. This content has been developed by all partners in Teams-meetings and discussions, and Uni-Freiburg answered for and wrote the report.

Didactic choices for the course, organization and implementation includes both social and individual levels. The course will have its starting point in inclusive and society-based didactics as the overarching teaching approach with an activity space for equal treatment as a prerequisite for creating interaction.

The course modules' basis is developed to be flexible, student centred and with a blended learning approach involving in-class as well as online learning. They are adapted to the findings from surveys and interviews in D2.1, in understanding the course participants' preferences.

The blended learning will be combined with collaborative learning in groups for solving problems or complete tasks. When incorporating collaborative learning into the nZEBRA course, participants can benefit from enhanced interaction and shared insights, leading to a deeper understanding of climate neutral buildings and related topics.

Student centred learning where the educator acts as a facilitator will be beneficial for the nZEBRA project and the students will then have full control over what and how they learn, and how they demonstrate their knowledge. Formative assessments play a crucial role in blended learning environments by providing ongoing feedback that informs both teaching and learning adjustments, but both summative and formative assessment will be in use.

Blackboard is the communication platform chosen for online activities facilitating both synchronous (Educator led/IRL) and asynchronous (online/selfstudy) learning activities.

1 Introduction

1.1 Aim of this report

The nZEBRA project is a blended learning course targeting two groups: master students and professionals in need of upskilling their knowledge with climate neutral nearly zero energy buildings. The contribution of this deliverable is to make a compilation of the methodological framework as it has been developed in WP 2 by all partners in meetings, discussions and written communication from the kickoff in 2023 to October 2024. The participants in the co-creation process are at the same time the target users of the course and will include student in scientific careers and master courses, as well as early researchers and technical professionals. No references from the previous reports are listed in this report.

1.2 Partners' contributions

The following Table 1 lists the contributions of project partners in this deliverable.

Table 2: Contribution of partners

Beneficiary name	Contribution
HH	D2.2, D2.3, D2.4
3OC	D2.1
HEP ESCO	D2.1, D2.2, D2.3
UFR	D2.2,
TUHH	D2.2, D2.3
ULUND	D2.3

1.3 Relation to other activities in the project

Table 2 below lists how this deliverable relates to other activities (or deliverables) in the project, and which should be considered for further understanding.

Table 3: Relation to other activities in the project

Related WP / task / deliverable	Relation
WP3	It will provide the framework for the nZEBRA course, according to the decided design of the course.

2 Course content and format for the course

2.1 About the Analytical report

D2.1: Analytical report on target groups' learning needs and preferences, identified the main learning objectives and set guidelines for the nZEBRA course content using quantitative as well as qualitative methods. A global overview of the results indicates that the course should be multidisciplinary offering a wide and holistic view of climate neutral buildings.

Concerning the content of the course, the areas where the most frequent value was 100 were: Electricity and energy, project management, environmental studies and digital tools. Topics considered vital for an important part of the respondents, was electricity and energy, project management, environmental studies and digital tools. The areas obtaining higher median (70) were: building and structural design, architecture and urban planning, eco-design and circular economy, electricity and energy, environmental studies and digital tools.

Important specific technologies for climate neutral buildings was smart grids and demand side management, district heating, batteries, thermal storage and building façades. Renewable technologies to consider were wind and solar, biofuels, biogas, biomass and wind.

The preferred format of the course was practical training with hands-on sessions, but overall, the most adapted form of training were a mix of in-person training and virtual materials.

Table 1, The main recommendations, in short, for the course creation

	Thematic areas	Technologies	RES technologies	In-person vs virtual training	Typology of activities
Top priority	<ul style="list-style-type: none">- Electricity and energy- Environmental studies- Digital tools	<ul style="list-style-type: none">- Smart grids and demand side management- District heating- Thermal storage	<ul style="list-style-type: none">- Solar- Wind- Biomass	<ul style="list-style-type: none">- In-person training	<ul style="list-style-type: none">- Hands-on sessions- Thematic workshops- Co-creation workshops
Also important	<ul style="list-style-type: none">- Project management	<ul style="list-style-type: none">- Batteries- Building façades	<ul style="list-style-type: none">- Biofuels- Biogas	<ul style="list-style-type: none">- virtual materials allowing flexibility	<ul style="list-style-type: none">- videos and online activities- competitions among students- job opportunities description

3 Decided didactics – a teaching perspective

3.1 Didactical approach

Didactic choices for the course, organization and implementation includes both social and individual levels. The course will have its starting point in inclusive and society-based didactics as the overarching teaching approach with an activity space for equal treatment as a prerequisite for creating interaction. This didactic relationship must be mutually managed by the participants. It is also a democratic approach with the intention to be cautious about how power is distributed in practice.

Teaching can comprise various methodological views which from a multimodality perspective can view the meaning making as a form of design and re-design, where the one expressing is designing the content while the one interpreting the expression is re-designing the content. Online forum for interaction and networking between students provides further opportunities for re-designing and inclusion.

To develop understanding for the topic the student needs to interpret various resources in interplay with others and combine them in his or her specific way i.e. both designing and re-designing the topic content. The multimodal aspects are therefore central to the creation of meaning. This is the core and short description of the chosen didactics for the course content, organization, and implementation in nZEBRA.

By creating and designing a course content for blended learning on the web and on site nZEBRA offers geographic inclusion and by this opportunity for greater diversity for those with limited possibilities to take part in lifelong learning through vocational training or higher studies on advanced level. In a blended learning concept where the direct interaction described above, only can occur in a part of a course the student needs meaning making and understanding supported by a certain multimodality.

4 Decided pedagogical approach and learning models – the students' perspectives

4.1 Pedagogical approach

D2.2: Pedagogical approach and course syllabus, outlines the pedagogical and methodological frameworks, learning methods and outcomes, and a course syllabus on climate neutral buildings. This content has been developed by all partners in Teams-meetings and discussions, and Uni-Freiburg answered for and wrote the report.

The modules' basis is developed to be flexible, student centred and with a blended learning approach involving in-class as well as online learning. They are adapted to the findings from surveys and interviews in D2.1, in understanding the course participants' preferences.

Blackboard is the communication platform chosen for online activities e.g. enable literature, recorded live videos, communication and teamwork, and quizzes for each module to repeat new knowledge and to see one's own understanding of the module contents. Blackboard facilitates both synchronous and asynchronous learning activities such as Flipped Model, Face-to-face Model and Rotational Model as well as Flex model and Enriched Virtual Model.

4.2 Learning models

In flipped model the traditional classroom instruction is reversed as students engage with learning materials outside class, and the time in class is used for discussions, group projects and activities to help reinforcing the new knowledge gained.

The face-to-face model is used in class or individually online with guidance from an educator and closely resembles traditional training in class.

A rotational model uses various modalities; face-o-face, online, small group discussions and independent study allowing students to work in the modality best suited for their needs.

The flex model grants autonomy and control over the learning paths combining online learning with in-person support as needed. An adaptive learning platform offers flexibility to choose when and where to access material resources, and meet with instructors when needed.

The enriched virtual model combines the flexibility of online learning with the benefits of in-person interaction, ensuring both individualized instruction and opportunities for group engagement.

The blended learning will be combined with collaborative learning in groups for solving problems or complete tasks. When incorporating collaborative learning into the nZEBRA course, participants can benefit from enhanced interaction and shared insights, leading to a deeper understanding of climate neutral buildings and related topics.

In the experiential learning-by-doing outside the academic setting at the end of the course, students will engage in activities requiring critical thinking, problem solving and decision making enhancing their understanding of theory on nZeb. By also integrating hands-on learning into the nZEBRA course, participants can gain practical, tangible experience in sustainable building practices, further enhancing their learning and skill development.



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5 Decided learning methods and tools

5.1 Learning methods

The course will emphasize constructivist and collaborative learning models and focus on knowledge through experience, reflection and critical thinking. Learning-by-doing provides tangible practical real-world experiences complementing theoretical knowledge. The didactic and pedagogical approaches are essential for activating students in the learning process.

Problem based learning (PBL) and challenge-based learning (CBL) together with case based learning will be used when the students work in groups. The individual learning will consist of live lectures that will be recorded and placed on Blackboard for those students who miss the occasions. Furthermore, study of course literature and quizzes are parts of the individual learning as well as individual assignments.

As the chosen methodological framework is based on constructivist learning it will help students to connect new knowledge with their previous experiences, enhancing their understanding. Constructivist teaching/learning includes continuous feedback which is encouraging students to analyze their learning process and identify fields for personal and professional growth.

Student centred learning where the educator acts as a facilitator will be beneficial for the nZEBRA project and the students will then have full control over what and how they learn, and how they demonstrate their knowledge.

5.2 Learning tools

Blackboard, an application designed for online teaching, learning, community building and knowledge sharing, is chosen as a managing tool for the course. This platform will be integral in enabling both synchronous and asynchronous interactions, supporting live discussions, and facilitating a seamless integration of various learning activities.

Lecturing online can use Teams or Zoom and both meeting applications have video recording, and the recorded files can be integrated into Blackboard for asynchronous learning. Google Meet can also be used if an institution is already using Google Workspace.

6 Course syllabus

6.1 The modules

The course syllabus has six modules and the initial draft contents have been updated. The aim is to align and adapt to the findings from surveys and interviews in D2.1, in understanding the course participants' needs and preferences.

1. Climate change adaptation (ULUND) 1.5 ECTS
2. Circular economy and Environmental Social Governance (HH) 0.5 ECTS
3. Life cycle assessment, LCA (TUHH) 1.5 ECTS
4. Energy generation/supply in buildings (UFR) 1.5 ECTS
5. Energy and Building physics; indoor climate, HVAC (HH) 1.0 ECTS
6. Smart buildings (HEP ESCO) 1.5 ECTS

One credit/ECTS equals an average workload of 30 hours, including lecture time, self-study and other learning activities.



7 Decided assessment strategy

Assessment methods must be carefully designed to evaluate both theoretical understanding and practical application. Both formative and summative assessments will be used.

Formative assessments play a crucial role in blended learning environments by providing ongoing feedback that informs both teaching and learning adjustments. These assessments are integrated into the learning process, allowing students to continuously practice and demonstrate their understanding. Techniques such as quizzes, assignments, and reflective activities are effective in promoting student engagement and self-regulation.

Summative assessments, such as exams and projects, evaluate students' overall understanding and application of course content. In blended learning courses, especially those employing flipped classroom models, summative assessments often take the form of final projects or presentations that synthesize online and in-class learning. The design of these assessments should reflect the complexity of the learning objectives, and the skills students are expected to demonstrate.

The assessment in the course will be made in accordance with the specific objectives in each course module, and the credit system in accordance with the European ECTS framework, allowing for international recognition and transferability of credits. For professionals outside academia a certificate without advanced grading will be given on fulfillment of the course.

Successful completion of the course includes assessment of participants' engagement in interactive and practical learning e.g. problem based learning and group projects, presentations and individual assignments such as completed quizzes. The whole process in the course and its workflow is illustrated in Figure 1 below.

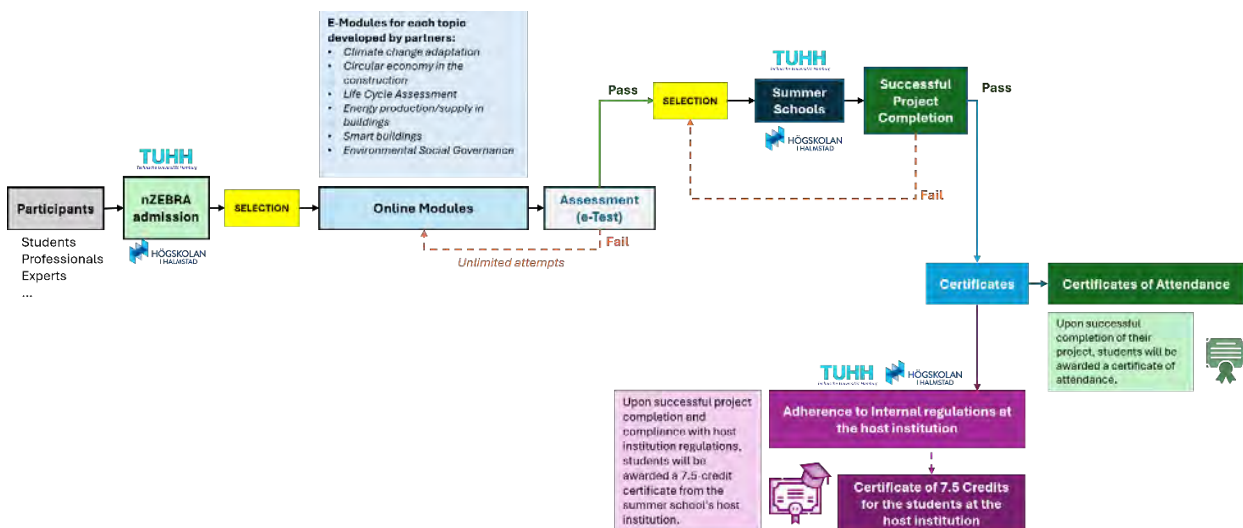


Figure 1. nZEBRA workflow and assessment strategy, from D2.3

8 Methodological framework

The methodological framework is showed as an overview in Table 5 in report D2.2, but as it has been developed since the summer. Now in October 2024 the modules are defined as described above in the text on Syllabus. The nZEBRA partnership has managed all tasks so far and during our meetings and discussions we have come to solutions summarized in this report.

Table 2 nZEBRA Methodological framework

Topic	Leader	ECTS	Learning objectives	Pedagogical approach	Learning tools	Course syllabus
Climate change adaptation	ULUND	1.5	✓	Blended learning, constructivist approach	To be defined	✓
Circular economy and Environmental Social Governance	HH		✓	Blended learning, constructivist approach	Reading, discussions and writing assessments	✓
Life cycle assessment, LCA	TUHH		✓	Blended learning, constructivist approach	To be defined	✓
Energy generation/supply in buildings	UFR		✓	Blended learning, constructivist approach	Energy+,PVsyst	✓
Energy and Building physics; indoor climate, HVAC	HH		✓	Blended learning, constructivist approach	To be defined	✓
Smart buildings	HEP ESCO		✓	Blended learning	Energy management tool	✓



9 Conclusion

The pedagogical approach and methodological framework and course syllabus provide a blended learning approach tailored to modern educational needs with in-class and online learning methods. Experiential and hands-on learning, continuous feedback and reflective practice are discussed and are appointed in the course pedagogy.

Learning objectives and outcome, and didactic methods are designed, and digital platform/tool chosen. Blackboard as an advanced learning tool and platform will play a crucial role in supporting nZEBRA's pedagogical implementation. Other key aspect of the pedagogical framework are multimedia and communication tools to facilitate both synchronous and asynchronous learning activities.

The project has designed the comprehensive assessment strategy aligned with the pedagogical and methodological frameworks with student-centered approaches. It addresses the specific requirements of universities, meeting the grading systems and credit structures, ensuring compatibility with academic frameworks. Certificates of attendance will be issued to all participants, with credit certifications handled on a case-by-case basis.

In summary, the whole project provides a structured yet flexible framework, but also ensuring inclusive, and effective evaluations. Both formative and summative assessments will be used, with adherence to institutional requirements. The assessment strategy will equip students with the necessary skills and knowledge to contribute to sustainable and climate-neutral building practices.



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