



Shape the future through great learning experiences



A Collaborative Approach to Education for Sustainable Development

United 4 Smart Sustainable Cities (U4SSC) Labs
and Newton Rooms

Executive Summary

This proposal draws a clear connection between FIRST Scandinavia's Newton Concept and the United 4 Smart Sustainable Cities (U4SSC) initiative, outlining the benefits of a partnership between the two entities.

We propose that every U4SSC lab includes a partner Newton Room with the goal of expanding the lab's outreach and educational programming to build awareness and knowledge about smart, sustainable cities from a young age.

On the following pages, you will find a brief introduction to the Newton Concept, including an introduction to our specially designed brick-and-mortar learning spaces, called Newton Rooms, as well as an overview of our educational programming. Key benefits of a U4SSC and Newton collaboration will also be outlined, including how this partnership will deliver Education for Sustainable Development, promote community investment in education and sustainability, and build strong connections with local industry partners.



Introduction

Newton Rooms are interactive learning environments that offer practical education in science, technology, engineering, and mathematics (STEM) for K-12 students. Through quality-assured and curriculum-based teaching modules, young learners of all ages encounter innovative equipment and varied, explorative working methods. Our interactive learning modules engage with real-world challenges, empowering students with the 21st century skills needed to address the interconnected challenges we face in shaping the future of smart and sustainable cities.

The Newton Concept is owned, developed, and managed by the non-profit foundation FIRST Scandinavia. Since 2000, FIRST Scandinavia has developed and implemented STEM concepts and projects for over 500,000 children and youth. FIRST Scandinavia established the Newton Concept in 2003 to address the lack of hands-on activities, outdated equipment, and shortage of resources for science laboratories in Norwegian schools. Recently, FIRST Scandinavia has embarked on a journey to expand the Newton Concept internationally; since 2015, Newton Rooms have opened in 4 new countries, with an additional 4 currently under development.

Driven by the idea that education should be both impactful and transformative, the Newton Concept inspires children and youth to make informed decisions and engage in collective action – particularly in relation to achieving the Sustainable Development Goals (SDGs). Most importantly, we recognize that quality education, and particularly Education toward Sustainable Development (ESD), is a key enabler of all 17 SDGs.

The Newton Concept and Newton Rooms

Every Newton Room is brought to life in a community through a partnership of key stakeholders -- a municipality and its school system, a community-based education partner such as a non-profit or science center, one or several donors who are usually STEM industry corporates, and the Newton team at FIRST Scandinavia.

This partnership jointly establishes the desired educational outcomes and programming and shares the responsibility of providing the necessary resources for successful delivery.

As a whole community resource, a Newton Room is often located at a community center, museum, or local partner location, but rooms can also be housed at a STEM-based institution, a school willing to provide open access to the Room, or even an industry partner location in the right circumstances.

Donors, school systems, and the Newton team work together to tailor the theme and goals of the education to meet the needs of all stakeholders.



Newton Rooms typically adhere to a set of shared principles, which are shaped to fit the dynamics of the partnership in each community. Specifically, Newton Rooms should:

- Focus on science, technology, engineering, and mathematics (STEM) topics
- Deliver approved Newton Modules
- Follow current guidelines within the Newton Concept
- Maintain a connection to a relevant local or national educational authority
- Employ local teacher(s) with a high level of academic and didactic competence
- Use equipment that promotes learning through activity
- Ensure that the room is open and accessible to area schools
- Evaluate the educational programming offered regularly
- Engage with the wider Newton community using newtonroom.com
- Report annually to the Newton team at FIRST Scandinavia

The Design and Function of a Newton Room

Classroom design greatly impacts student engagement and learning outcomes. That's why, with over a decade of experience, we have fine-tuned the Newton Rooms to facilitate a holistic and engaging STEM learning experience for K-12 students.

Flexible in shape and size, Newton Rooms generally span an area of between 150m² -250m². Each room is equipped with a standard set of elements such as mobile student workspaces to be used for group work, an area designated for collaborative discussions and reflection, and a lab where students can conduct scientific experiments using onsite equipment.

Newton Rooms also come equipped with state-of-the-art AV, sound, and zone-based lighting systems that are both easy-to-use and directly support our interactive learning model. Many rooms integrate innovative technologies, such as smart walls and surfaces, transparent touch screen technology, Active Floors, humanoid robots, holograms, and more.

In every case, we are committed to working with local stakeholders to develop custom design solutions. As a result, individual settings and conditions make each room unique.

Each room, wherever it is located in the world, is continuously supported by our online teaching and learning portal, as well as our international teacher's network.

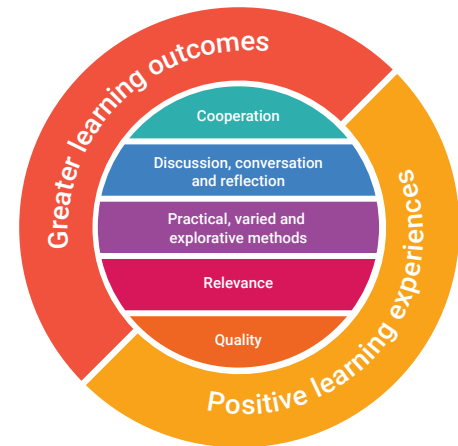


Educational Programming

Newton Modules

Newton Modules, the educational programming offered in our Newton Rooms, are designed, developed, and quality-assured through careful collaboration between Newton's own pedagogical team, local teachers in each community, and leading education experts at the Norwegian University of Science and Technology (NTNU). Each module is aimed at achieving both specific learning outcomes and a positive learning experience for our young learners.

We currently offer a range of approximately 20 modules, each aligned with the local curriculum and targeted at specific age groups. Every module consists of pre-and post-work that is completed in the classroom with the local teacher. Undoubtedly, the highlight for most students is the visit to the local Newton Room to conduct a set of prescribed learning activities. The duration of the modules varies depending on the level, but generally, each module lasts between 3 and 10 hours.



Examples of our Learning Modules

ANIMALS AND PLANTS ON THE SEASIDE



Quick facts	
<p>Animals and Plants on the Seaside</p> <p>This module deals with organisms that live in the intertidal zone. The purpose is to give students a better understanding of the species and the interaction on the shore through practical experience. Pupils should collect plants and animals and classify, record and group them. They use a stereo magnifier and microscope at work.</p> <p>Much of Newton's Day takes place in the field. It contains three outdoor activities:</p> <ul style="list-style-type: none"> • Collection and determination of species of seaweed and kelp • Collection and determination of species of animals • Collection of plankton (plankton cover) <p>The class will return to the Newton Room and use a magnifying glass and microscope to determine the remaining plankton and other species, not determined outside. The students are challenged to talk about how animals and plants on the shore are adapted to their environment by emphasizing the special features of different organisms. Students work in pairs throughout the module.</p> <p>NB! The module must be completed on days that are suitable in relation to high and low tide. Remember to check the tide tables!</p> <p>Pre- and post-work at school</p> <p>In order for the pupils to have a good enough academic basis for the excursion, it is recommended to set aside three school hours for pre-work. These hours should be scattered as the subject matter is relatively extensive. The pre-work focuses on general ecology in the sea, as well as examples of species and systems. In the post-work, the students will work individually to prepare brochures where they present their thoughts on the field work.</p> <p><small>(the module could be adjusted for other ecosystems such as forest, etc.)</small></p>	<ul style="list-style-type: none"> • Duration: 6 hours & pre- and post work • Target age group: 10-12 years • Number of students: 18
Framework	
<p>Science – Students should be able to explain how organisms can be divided into main groups and give examples of the special features of different organisms.</p>	

SOLAR CELLS AND SOLAR COLLECTORS



Quick facts

- Duration: 6 hours & pre- and post-work
- Target age group: 16 years
- Number of students: 21

Framework

Science: Energy for the future: The students will be able to experiment with solar cells and solar collectors, explain the main features of their operation and make simple calculations of their efficiency.

Science: The budding scientist: The student should be able to plan and carry out different types of investigations with identification of variables, obtain and process data, and write report with discussion of measurement uncertainty and assessment of possible sources of error.

Solar Cells and Solar Collectors

The module concerns solar energy and how it is utilized for the production of electrical energy and heat. In the Newton Room, students will be able to explore solar collectors and solar cells through practical tasks and they will encounter theory related to the activities. Students write a continuous report for each experiment.

The module consists of six activities:

- Activity 1: The solar cell as a power source. Students will study various parameters that affect electricity production, as well as learn how to calculate efficiency.
- Activity 2: Solar cell car. Students will study the relationship between charging time and mileage on a small car and examine how a solar cell is used to charge a battery.
- Activity 3: Solar collector - greenhouse model. Students will be introduced to a solar collector with water pipes and learn how to calculate its efficiency.
- Activity 4: Which colour best captures sunlight? Students will register temperature increase in bottles with different colours and opacities.
- Activity 5: Satellite solar collector. Students will find the focal point of a satellite dish collector.
- Activity 6: Solar oven. Students will learn the functionality of a solar oven and how to use it to cook a meal.

LIFE OF THE BUMBLEBEE (BEE-BOTS)



Quick facts

- Duration: 2 hours
- Target age group: 4-5 years old
- Number of children: 10

Framework

Nature, environment and technology:

- preschools shall contribute to the children's increased knowledge of nature and sustainable development, learn from nature and develop respect and incipient understanding of how they can take care of nature

- staff shall explore and experiment with technology and natural phenomenon together with the children.

Number, room and shape:

- preschools shall ensure the children play and experiment with numbers, quantify and counting and gain experience with different ways of expressing this

- staff shall use digital tools and equipment to inspire children to think mathematically.

Life of the Bumblebee (Bee-Bots)

In this module the children will learn about bumblebees and life of the bumblebees. They will get familiar with fundamental algorithmic thinking through play and programming the small robot bumblebees (bee-bot). The children will marvel at how bumblebees and bees manage to obtain food, distribute pollen and make honey.

This is the children's first encounter with the Newton Room. Play and getting comfortable in the room is also an important goal.

The module consists of four activities:

- Activity 1: Introduction about bumblebees. The children sing, join conversations, greet BumbleBumble, study a flower and watch a short animation movie.
- Activity 2: We are bumblebees. The children play and pretend to be bumblebees
- Activity 3: Programming. Introduction to bee-bot, the children program the robot to follow a road to the flowers and play with the bee-bot.
- Activity 4: Dialogue and sensations. What can we do to help the bumblebees, conversation, bring awareness to the senses, taste and smell honey, different bumblebee breeds.

The plan for the module should be flexible so that there is time for questions and contribution from the children.

Education toward Sustainable Development

The integration of Newton Rooms within each United for Smart Sustainable Cities (U4SSC) lab will provide an opportunity to build critical STEM skills for K-12 students in cities around the world. Newton Modules, taught in each of the rooms, will equip young learners with an understanding of how science and innovation can meet the sustainability challenges of cities, both now and in the future.

With a growing collection of learning modules to choose from, our educational programming can be tailored to local contexts and curriculums, and easily aligned with the Key Performance Indicators (KPIs) established by the U4SSC for global cities. The development of new modules in collaboration with our in-house pedagogical experts, as well as the creation of special competitions and projects related to smart and sustainable cities, is also possible.



Community Investment

Establishing a Newton Room is a long-lasting investment in a community's education infrastructure, particularly as Newton Rooms often serve as a focal point for multiple schools in a specific community or geographic region. Newton Rooms also contribute to the capacity building of local teachers.

Once a room is established, our education team trains teachers from the local community to deliver the selected modules in the local language. This provides a framework for teachers in the community to expand their pedagogical and teaching repertoire. Furthermore, a collaboration between U4SSC and FIRST Scandinavia provides a unique opportunity to engage with the growing international network of Newton Teachers and foster further collaboration between educators across borders, particularly on the topic of smart, sustainable cities.

Connections with Local Industry

Students will not only be exposed to curriculum enhancement through Newton programming but also the relevant programs, interactions, and opportunities offered by each U4SSC lab.

Collaboration with local U4SSC partners will provide students with additional opportunities to engage with local industry around shaping smarter and more sustainable cities. This includes cooperating with local industry on employment engagement opportunities aimed at introducing students to new technologies and showcasing future career paths.

Finally, the physical space of a Newton Room not only supports in-school programs but can also be used for co-curricular activities or programs that take place outside of school time. Therefore, the room can also function as a space to support other relevant programming offered by the lab..

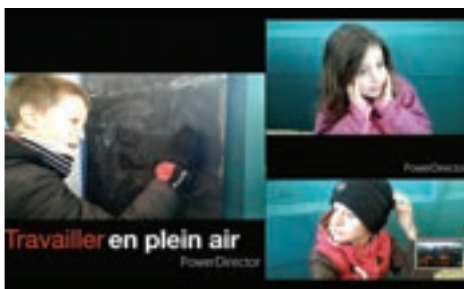


Future Module Development

Our existing modules correlate directly to over 50% of the SDGs and also align thematically with over 25% of the KPIs outlined for global cities as part of the U4SSC initiative.

While some of our current modules may be able to be modified to better support or address urban sustainability challenges, we also aim to develop new modules together with the U4SSC team and other external stakeholders for future use in Newton Rooms.

Potential topics for the expansion of our international library include Urban Planning, Transportation, Air Quality, and Information and Communications Technology.



“Shape the Future with Newton”: Local and Global Challenges for Students

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The Global Expansion of the Newton Concept

The FIRST Scandinavia team is committed to the continued international expansion of the Newton Concept, scaling the project to empower students via STEM education in communities around the world. The first Newton Rooms opened in 2007, and today there are 38 rooms operating in Norway.

In just the last five years, we have expanded the Newton concept into continental Europe and the United Kingdom, and are now reaching communities in Asia such as China, Turkey, and Azerbaijan. We have established a charitable entity, Newton America, in the United States as of 2021.

In parallel, we continue to have discussions with interested parties in South America, India, Australia, and Canada, amongst others. Our growing footprint, coupled with the planned expansion of the U4SSC labs globally, provides an excellent opportunity for impactful collaboration.

The Newton team sees several additional special programs, enabled by the Newton Room and leveraging existing Newton efforts in development which could be built out in cooperation with U4SSC and individual labs to expand programming. Our goal is to establish a true partnership, collaborating with the U4SSC team to help ensure that future generations gain the knowledge and skills necessary to help cities around the world make progress toward the KPIs, while also generating new opportunities for the Newton Concept to support the SDGs.



Key Partnership Benefits

The establishment of a Newton Room marks a lasting and impactful investment in developing smart and sustainable cities. The integration of Newton Rooms into the U4SSC labs would bring a number of mutually beneficial outcomes:

- U4SSC labs will gain access to a proven education framework and specially designed classroom based on FIRST Scandinavia's nearly fifteen years of experience in providing STEM learning opportunities for K-12 students.
- Both U4SSC and Newton Rooms place high value in developing knowledge hubs that are firmly embedded within the community and benefit from involving stakeholders from a diversity of fields. Bringing these stakeholders together will only catalyze community efforts in achieving the KPIs outlined by U4SSC.
- K-12 students who visit the U4SSC labs and partner Newton Rooms not only gain key competencies in STEM subjects but will also gain an increased awareness of sustainability issues related to their own urban surroundings.
- Teachers and students invited to the Newton Rooms and U4SSC labs will engage directly with issues facing sustainable and smart cities, thus empowering them to make informed decisions about their own lives and communities.
- Students and teachers will gain connections to relevant industry experts and employees and connect to other non-Newton U4SSC initiatives, providing a broader introduction to future career paths.
- The U4SSC initiative will gain significant traction within the field of STEM education through a partnership with FIRST Scandinavia, gaining access to an international network of highly trained educators.
- The international network of Newton Teachers will also benefit from the experience and expertise of the U4SSC in driving educational initiatives that contribute to the achievement of SDGs everywhere.

By building a strong and dynamic partnership between Newton Rooms and U4SSC labs around the world, it will be possible to train the next generation of city leaders and help secure a future with smarter, more sustainable cities.

Meet the FIRST Scandinavia Team

FIRST Scandinavia was founded in September 2000 with the goal of providing children and young people with good learning experiences, particularly in the fields of science, technology, engineering, and mathematics (STEM).

Since its inception, the FIRST Scandinavia Foundation has developed and implemented concepts and projects in the field of STEM for more than 500,000 children and youth. FIRST LEGO League (FLL) Scandinavia and Newton are the organisation's two most important concepts.

FIRST Scandinavia is headquartered in Bodø, Norway and owns and operates the FLL and Newton concepts. Most recently, Newtonroom gGmbH was founded as a non-profit organisation with an office in Berlin, Germany, whose aim is to further the implementation of the Newton concept internationally.

Together, the team is comprised of 30 full-time employees.

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