Designing Environments for Teaching Sustainability Citizenship in Schools

SYNAPSES

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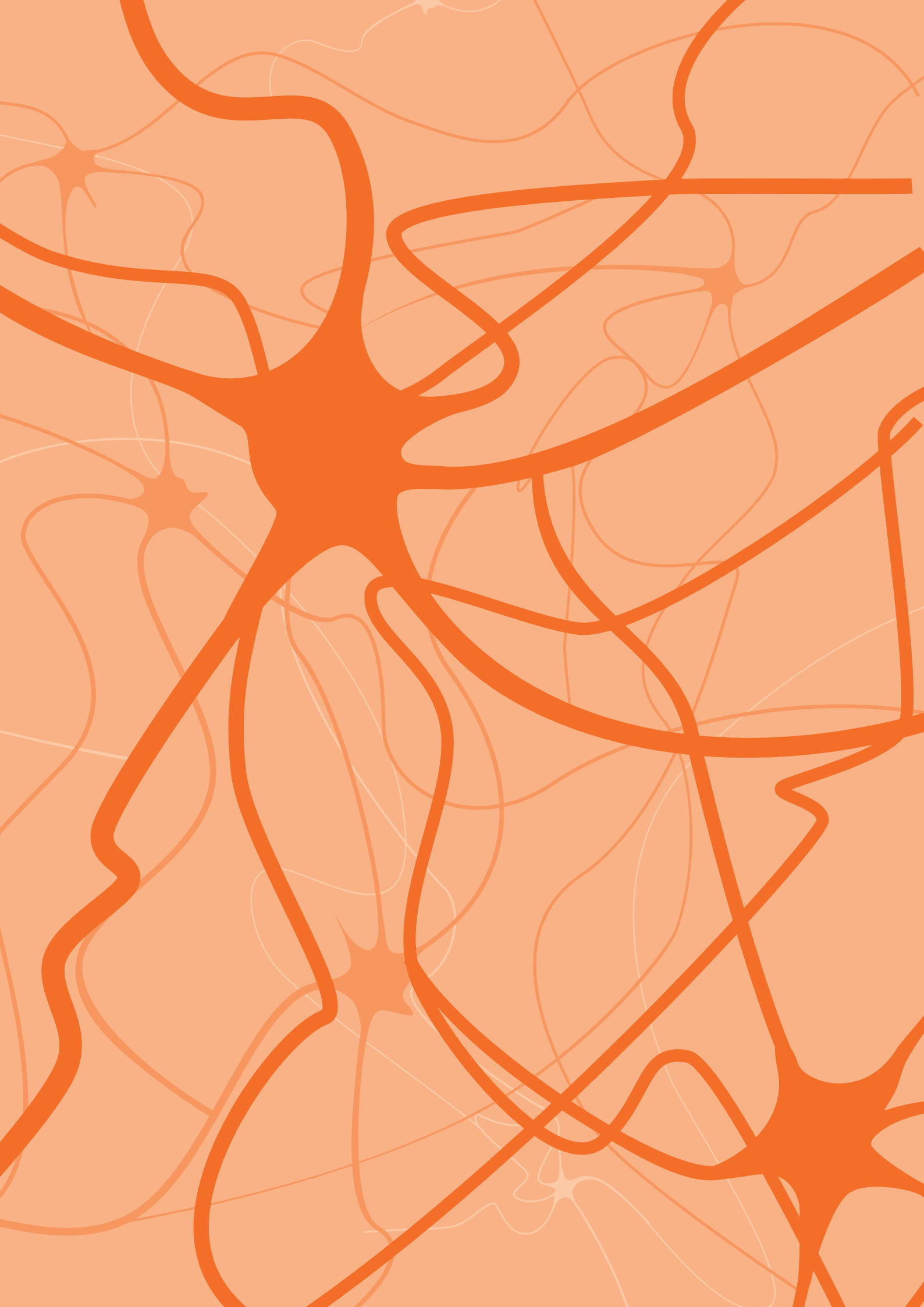
INTRODUCTION



1.1 SYNAPSES Academy

In SYNAPSES, based on the current political climate formed by the European Green Deal and the 2030 Agenda for Sustainable Development, and in line with the ERASMUS+ Teachers Academies Action ambition, we present our vision on how pre-service and in-service programs on teaching for sustainability citizenship, could be interrelated and enriched to develop a joint offer with significant European dimension. Sustainability Citizenship (SC) (Roczen et al., 2014) has great potential for cultivating agents of change who not only envision but also enact solutions to climate change. Teaching for Sustainability Citizenship can stimulate and lead to an action-including decreasing consumption and demand, developing sustainable food and energy sources, exploring nature-based solutions for the current challenges, using school buildings as teaching tools, and greening schoolyards. Arguing for a paradigm shift in the way we view education; the SYNAPSES Academy could demonstrate how our education systems can create new levels of awareness and work towards a sustainable future.

SYNAPSES is setting up the Erasmus+ School Heads and Teacher Training Academy on Teaching for Sustainability Citizenship to ensure and safeguard the long-term impact of the proposed activities. The Academy's main goal is to expand teachers' pre- and in-service training opportunities, under a common standard-based framework (see Figure 1). By introducing the concept of Learning Ecologies, the SYNAPSES Academy has the ambition to design and set up a strong training ecosystem. In such an ecosystem each piece is interconnected (with synapses) thanks to the common standard-based framework of SYNAPSES Academy: formal and informal training opportunities, short-term and long-term courses, self-paced activities, social learning and mentoring opportunities and involvement in virtual events or practical workshops with physical presence, participation to communities of practice, participation to conferences and seminars, job shadowing activities in other schools, participation in short term summer or winter schools.

SYNAPSES Academy also offers guidelines and tools for the effective organisation of training and the delivery of effective school heads and teachers training programmes. By offering teachers a large repertoire of training activities, tools, guidelines and other support, along with a detailed competence framework for their effective introduction in the school practice, the Academy professionalise and thus empowers teachers not only to change their teaching practice and introduce contemporary environmental issues in their lessons but also to propose and initiate the necessary changes in their schools, to allow for a more seamless introduction of innovations.

SYNAPSES strengthen the teachers' profession, by raising the standards for Environmental Education, Sustainability and Fighting Climate Change in pre-service and in-service training. It offers and facilitates learning about new innovative approaches to teaching. It provides a framework for implementing teacher training, combining the strengths of seminar workshops with possibilities of mobilities throughout Europe, bringing teachers in contact with each other to facilitate an enhanced exchange of experience, ideas and

knowledge about activities and opportunities for teaching environmental education in schools throughout Europe.

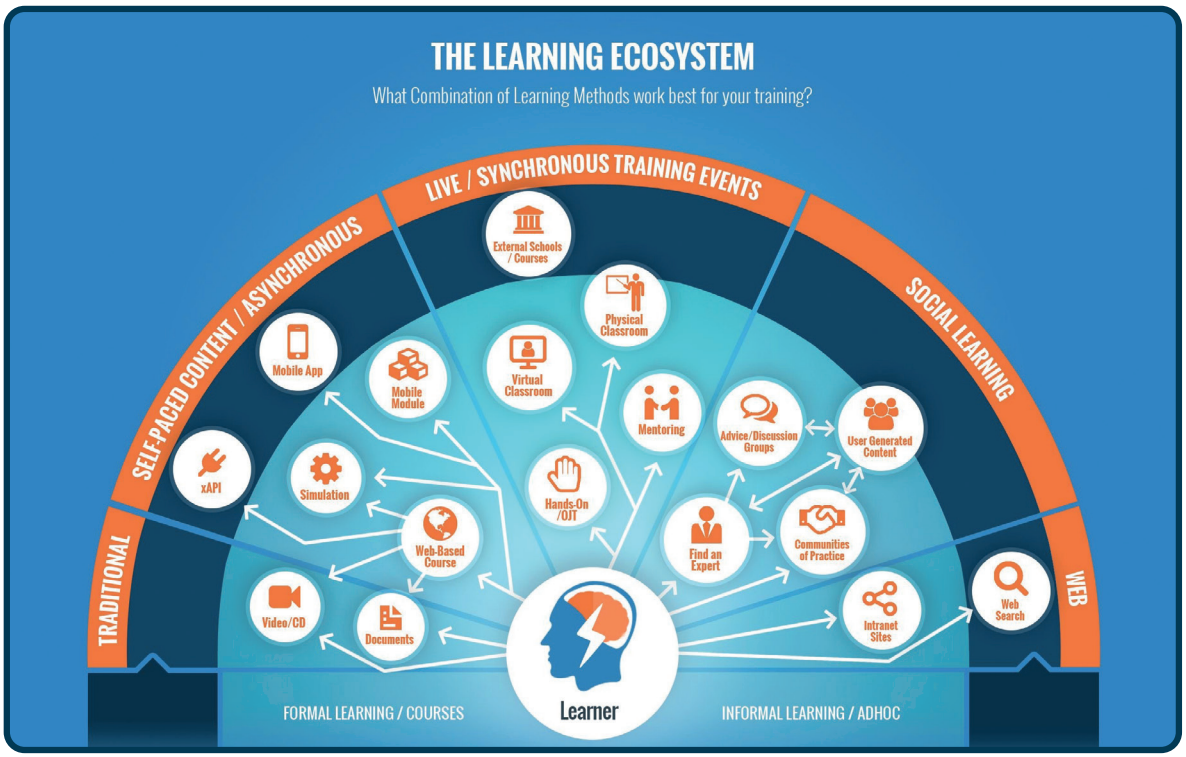
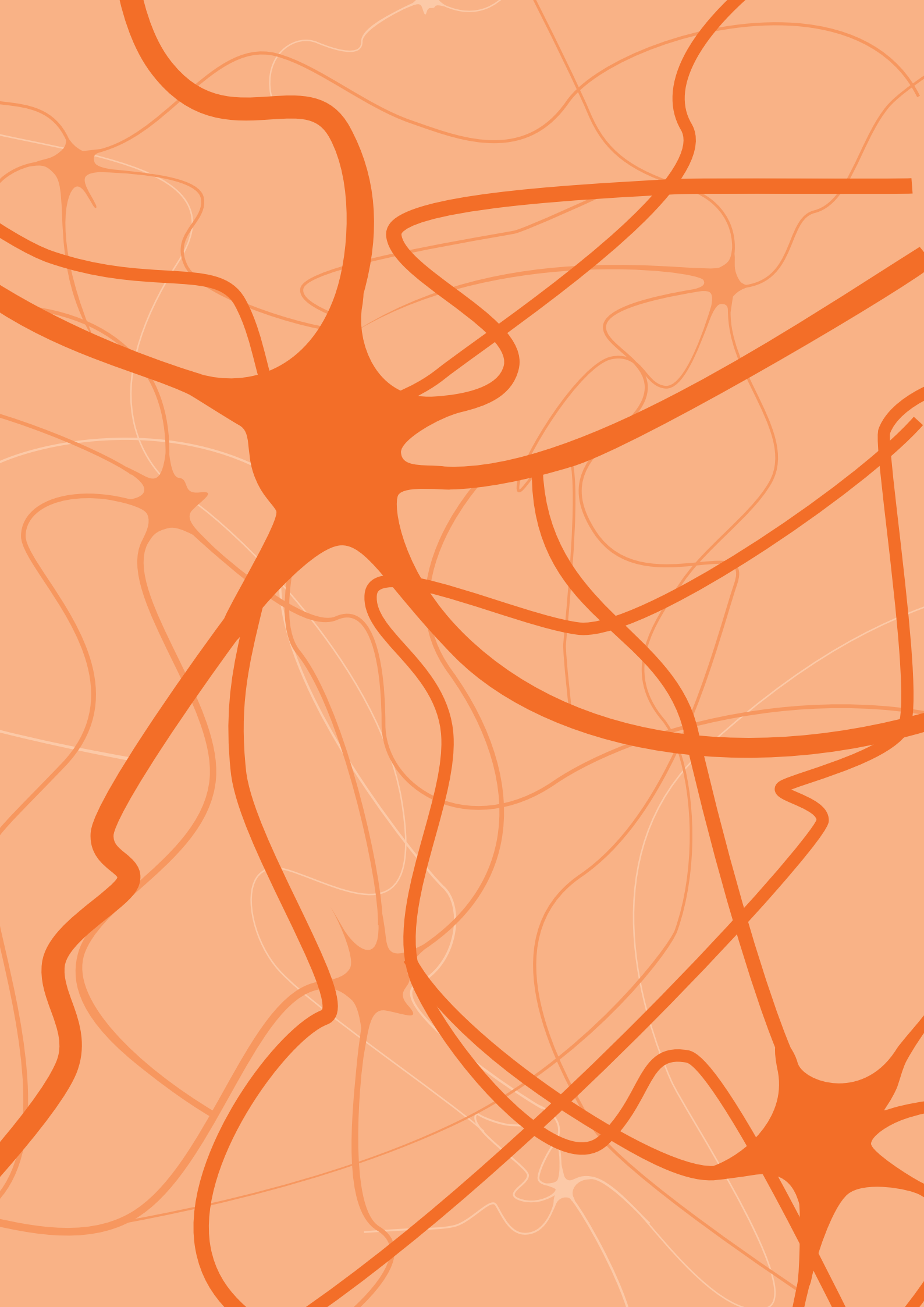


Figure 1. *The SYNAPSES Academy Joint Learning Offer to teachers will include a variety of activities designed to help them navigate the trials and tribulations of training and help them forge their own path forward towards professional development. A standard-based framework will provide the links (synapses) between the different parts of the training ecosystem.*



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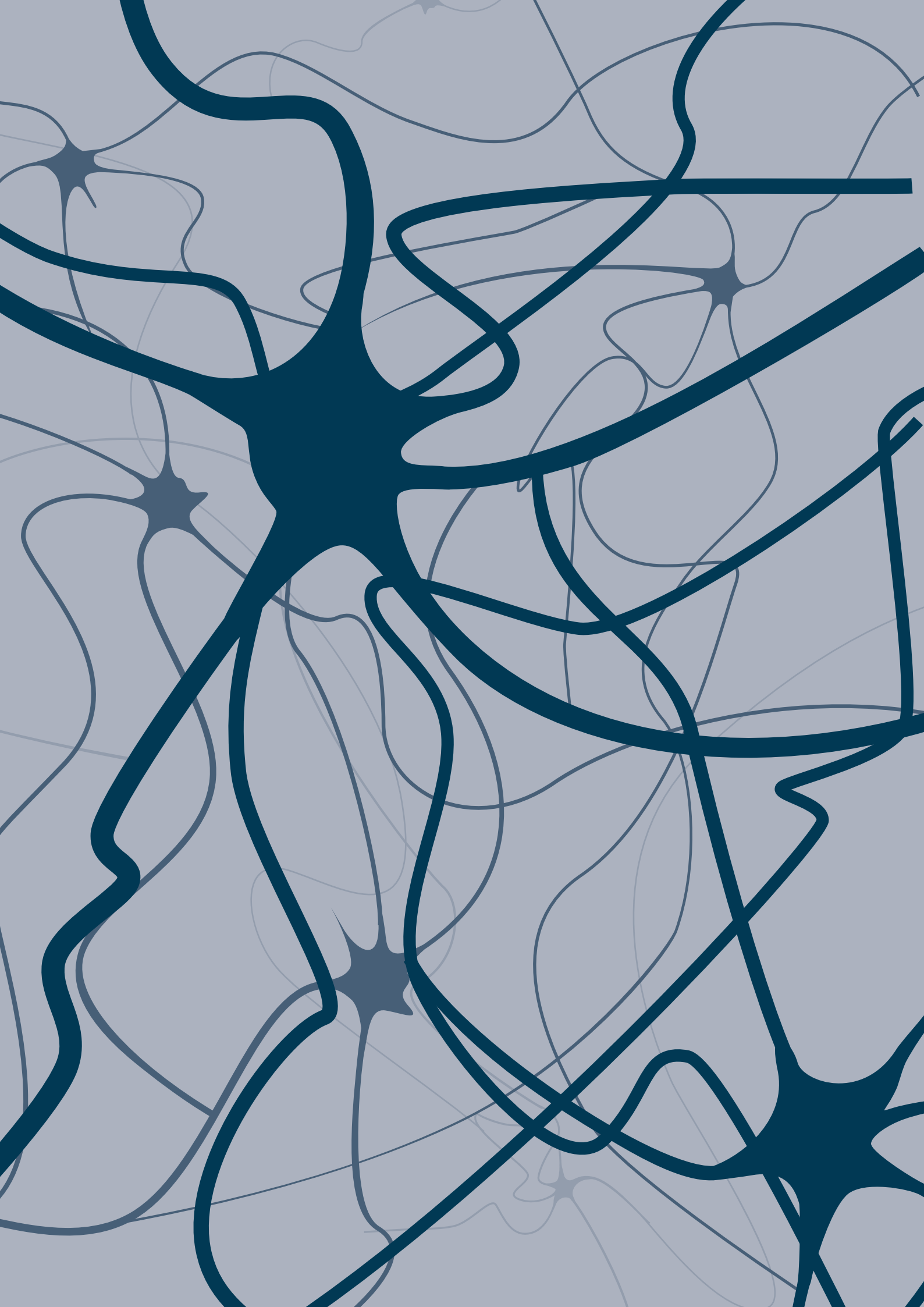
KEY FEATURES OF SUSTAINABILITY CITIZENSHIP



2.1 Building Sustainability Competences

To address climate change and achieve the transition to a greener and fairer economy and society it is crucial for everybody to strengthen and develop competences and skills that help us live, work and act more sustainably. To support the development and assessment of knowledge, skills and attitudes for sustainability, the Commission published GreenComp[1], the European competence framework on sustainability in January 2022. This framework, which has been translated into all official EU languages, is a general reference model. It does not target any education level in particular; rather, policy makers and practitioners can use it and adapt it to their contexts and needs in education and training programmes. Over the last two decades, EU Member States have increasingly adopted competence-based approaches to education. GreenComp fits well into this development as the definition of sustainability competences is based on the 2018 Council Recommendation on key competences for lifelong learning[2] which identifies competences as a combination of knowledge, skills and attitudes and which has been a reference document for education ministries across the EU.

In April 2023, the Commission launched a community of practice for ministries, schools and research and training bodies, including many who are active in Erasmus+ and Horizon Europe projects, using the new GreenComp framework on sustainability competences. The community of practice provides a forum for exchange, networking and collaboration for those stakeholders and is open for interested users to join. Large-scale policy experimentations should support education stakeholders and institutions to strengthen sustainability competence development and foster its systemic integration into education and training by building on the GreenComp framework. Embedding sustainability in a competence-based education can help learners foster a sustainability mindset based on the knowledge, skills and attitudes to think, plan and act with empathy, responsibility, and care for our planet.

The operation of the SYNAPSES Academy is grounded on the concept of sustainability citizenship. Climate change relevant sustainability citizenship skills include the ability to recognize the environmental, social, and economic dimensions of climate change, the ability to connect local actions and initiatives to global processes, and the capacity to move from analysis to systematic action on climate change. In this section we describe the concept of Sustainability Citizenship that is rooted to long term research in the field.

[1] https://publications.jrc.ec.europa.eu/repository/handle/JRC128040
[2] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.C_.2018.189.01.0001.01.ENG&toc=OJ:C:2018:189:TOC

2.2 Sustainability Citizenship

Sustainability citizenship is a concept that integrates the principles of sustainability into the roles, responsibilities, and rights of citizens. It is a form of citizenship that acknowledges the importance of balancing economic, social, and environmental aspects to ensure a sustainable future for all. Sustainability citizenship involves practices that contribute to the welfare of the environment and society, such as sustainable purchasing, reduced consumption, and green mobility. These practices are adjusted to citizens' capabilities and are connected to engaged citizenship norms with the intention of advancing social-ecological change.

However, it should be noted in passing that some practices can be limited by factors such as social class and age (Zorell & Yang, 2019).

Sustainability citizenship differs from conventional forms of citizenship in that it encompasses a broader range of responsibilities and actions, including those that address past and current injustices and worldwide responsibilities. While self-interest often dominates, there is a growing recognition of the need for nonreciprocal or other-regarding concerns (Micheletti & Stolle, 2012).

The concept is also closely related to ecological citizenship, which is a crucial concept in green political theory. Ecological citizenship aims to establish a new understanding of citizenship that is rooted in the environment and promotes sustainability beyond national boundaries, thus adopting a form of cosmopolitanism (Valencia Sáiz, 2005). SYNAPSIS Academy adopts Sustainability Citizenship as its working definition since it captures the more fundamental, more encompassing and active aspects of behavioural change towards more sustainable behaviour. In our view, Sustainability Citizenship critically resides on people's dedication and their self-determined motivation to protect the environment. People's self-determined sustainability motivation is durable against the test of time (see Kaiser, Brügger, Hartig, Bogner, & Gutscher, 2014), and relevant for people's lifestyles, visible for instance in their electricity consumption (see Arnold, Kibbe, Hartig, & Kaiser, 2018; indicated by the double-headed arrow between environmental attitude and sustainable lifestyle in Figure 2). Based on their research, Kaiser and colleagues have come to conceptualize people's self-determined motivation or dedication to environmental protection as environmental attitude (see, e.g., Kaiser, Oerke, & Bogner, 2007; Hartig, Kaiser, & STRUMSE, 2007; Kaiser, Byrka, & Hartig, 2010; Kaiser, Hartig, Brügger, & Duvier, 2011).

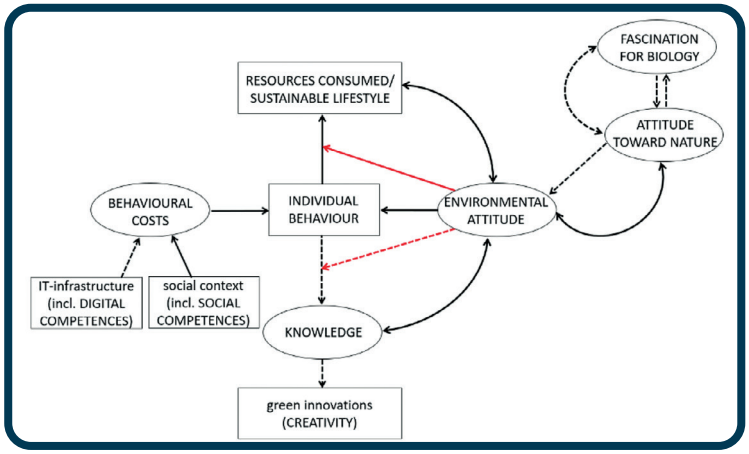


Figure 2. *The SYNAPSES Academy Standard-Based Framework. Solid lines reflect evidence-based relations; double-headed arrows stand for correlations; single-headed arrows for directed relations; dashed lines represent likely or presumed relations; ovals symbolise latent, not directly observable concepts; rectangles stand for manifest, directly observable concepts.*

Expectedly, people's environmental attitude discloses itself in the persistence with which people engage in energy-saving (see Henn et al., 2019), which shows in the attitude-moderated effect of behaviour on the resources consumed (the dashed red arrow on the black arrow in Figure 2).

Together with the costs of a specific behaviour (due to effort, distance, inconvenience, fees, lack of infrastructure, social constraints etc.), people's **environmental attitude** (their self-determined motivation to protect the environment) controls specific protective behaviours. This becomes apparent in the compensatory efficacy of environmental attitude and behavioural costs when they both account for individual behaviour in Figure 2 (solid black arrows: for evidence, see, e.g., Kaiser & Byrka, 2011, 2015; Byrka et al., 2017;Taube et al., 2018; Taube & Vetter, 2019; Kaiser et al., 2020). Behavioural costs derive from the cultural and social context (i.e., the boundary conditions) in which people act, and they are behaviour-specific (e.g., Kaiser & Biel, 2000; Kaiser & Keller, 2001; Scheuthle et al., 2005). As such, within the limits of a specific sociocultural context (e.g., Germany), behavioural costs constitute more or less universal "situational thresholds" for engagement (Campbell, 1963). According to Campbell, costs must be counterbalanced by an actor's personal attitude (for experimental evidence, see Kaiser & Lange, 2020).

Expectedly, sustainable citizens generally behave in less resource-consumptive and environmentally protective ways in their everyday lives (see, e.g., Kaiser, 1998; Kaiser & Wilson, 2004: indicated by the black arrow between environmental attitude and individual behaviour in Figure 2). Because of their raised dedication to protecting the environment, sustainable citizens not only vote for representatives with a known environmental protection record, recycle cardboard regularly, and avoid foods that are particularly environmentally harmful (e.g., meat), but they also refrain from flying and from owning a car (e.g., Kaiser et al., 2010, 2013; Henn et al, 2020, 2021), and they seize environmental protection-related learning opportunities. Consequently, we find sustainable citizens to know more about the processes within ecosystems (system **knowledge**), the things that can be done to protect the environment (action-related knowledge), and about the protective benefits of specific protective behaviours (effectiveness knowledge: see Kaiser & Frick, 2002; Frick et al., 2004; Roczen et al., 2014: double-headed arrow between environmental attitude and knowledge in Figure 3).

Accordingly, we must suspect a similar attitude-moderated persistence effect of learning (i.e., the specific behaviour) on the what people know (the dashed red arrow on the red arrow in Figure 2) as was found on people's engagement in energy-saving (Henn et al., 2019).

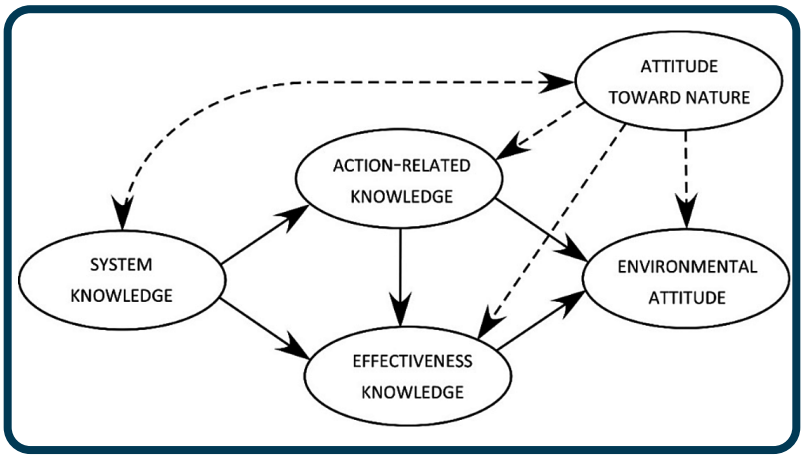


Figure 3. ***Competence model by Kaiser, Bogner, and Rozcen (see Kaiser et al., 2008; Roczen et al., 2014)***

The proposed competence framework in Figure 2 originates in the environmental competence model by Roczen et al. (2014) shown in Figure 3. In contrast to their work, we treat environmental knowledge as a single intellectual attainment consisting of the three more or less closely related facets system-, action-related and effectiveness knowledge. Concordant with their suggestion, we also regard people's appreciation for nature (i.e., **attitude towards nature**) as a promising experience to instigate people's environmental attitude (their dedication for environmental protection: see, e.g., Kaiser et al, 2013, 2014). The **attitude towards nature** or appreciation of nature is conceptualized as a positive attitude towards nature (Kibbe et al. 2014). Within the concept of environmental attitudes, it represents one of the two opposite poles of utilization. While an exploitative usage of nature is on the one end of the utilization spectrum, an appreciative usage of nature is the counter on the other end of the spectrum (Kibbe et al. 2014). Hence, this appreciative component of utilization includes the sustainable and conscious use of nature e.g., for recreational reasons, inspiration and connection with nature causing minimal or no exploitation of the natural resources (Brügger et al. 2011; Kibbe et al. 2014; Kaiser et al. 2014). Even though appreciation of nature includes self-interest and is based on personal benefits (Kaiser et al. 2013), it is expected to favour environmental protection and pro-environmental behaviour (Kibbe et al. 2014).

Therefore, the concept of appreciation monitors the enjoyable utilization of nature by measuring self-reported past behaviour (Brügger et al. 2011; Kaiser et al. 2014; Kibbe et al. 2014). The interaction of the appreciation of nature with other variables in connection with education sciences is of high relevance. Bogner (2018) and Raab et al. (2018) reported a positive association to preservation of nature indicating that people who appreciate nature have a preservative attitude. Between appreciation and utilization, no relationship was detected (Raab et al. 2018). Similarly, even though measured in different ways, this attitude variable has repeatedly been found to interact with ecological behaviour (Clayton 2003;

Mayer und Frantz 2004) and serve as the basis for a more self-interested motivation for environmental protection (Hartig et al. 2007).

As this first basic model secured the principal foundation, the empirical formulation of the lifelong learning competence framework requires many more input variable to fine-tune any assessment approach. Lifelong learning requires that people are not only able but also motivated to learn about and engage in environmental protection throughout the various stages of their personal lives continuously and actively. **Fascination** for science in general and **fascination in biology** in particular, **engagement** with science, **creativity** and **digital competences** play an important role in the overall framework:

Fascination for science: Fascination for science conceptually is rooting in the Campbell paradigm (Kaiser & Wilson, 2019). As a new variation of the tripartite model of attitudes (Rosenberg & Hovland, 1960), the Campbell paradigm proposes an attitude based on three dimensions: an affective, a cognitive and a behavioural component. The affective dimension is characterised by positive feelings and emotions towards a subject area, here science in general or specific scientific fields (Otto et al., 2020). The learning topic "aquatic ecosystems", for example, is supposed to trigger positive emotional reactions in a person who is fascinated with biology and who would enjoy learning more about marine wildlife. The cognitive component is reflected in the willingness to solve even complex scientific problems as well as to develop necessary skills, knowledge, and competences. The behavioural dimension manifests itself in the repeated and voluntary exercise of extracurricular activities and experiences. For example, students fascinated with biology will frequently watch TV documentaries about animal behaviour or observe garden birds.

Engagement with science: Ideas of engagement with science are comparable to school engagement theory (Fredricks, Blumenfeld, & Paris, 2004). Emotional engagement with science is supposed to be reflected in students' positive feelings and attitudes towards science and emotional reactions connected with scientific topics. This affective dimension of fascination can be expected to reflect in the enjoyment of learning scientific contents. Cognitive engagement can be defined as "thoughtfulness and willingness to exert the effort necessary to comprehend complex [scientific] ideas and master difficult [science] skills" (Fredricks et al., 2004). Thus, cognitively engaged learners are perceived as willing to gain new and deeper insights into scientific topics, and they appreciate the opportunity to deepen their scientific knowledge. Additionally, cognitive engagement becomes obvious when a learner expresses the importance of science and scientific knowledge. Behavioural engagement as the third dimension "draws on the idea of participation" (Fredricks, et al., 2004). It is characterised by the performance of voluntary, extracurricular activities and experiences relating to science, for example, reading science magazines or watching TV documentaries on scientific issues.

Creativity: Creativity seems to be one of the most difficult psychological constructs to explain (Corazza, 2016). It is easier to notice creativity and its effect when absent, for example, in unimaginative attempts at problem-solving. Because the more complex the

problem becomes, the more creativity is needed. Risen degree of environmental degradation and climate change with the ineffective policy so far prioritise individualisation of responsibility. Consumers need to develop sustainable consumption to contribute to sustainable development. Sustain living may require entirely new approaches and ways of living. However, since sustain behaviour has no traditional solutions, in addition to the broad social recognition of such behaviour, creative problem-solving skills of exceptional complexity and creativity is needed. It can be observed that people feel socially encouraged to participate creatively in problem-solving in appropriate communities (Kinga Polynczuk-Alenius, 2015). In the context of a globalised society with massive climate degradation, creativity has been identified as a key skill for the 21st century (Wagner, 2010). However, the school environment has been accused of neglecting this part of education: school seems to discourage children for more creativity, although school could also promote creativity (Barbot, Besançon, & Lubart, 2015). Since gender differences in creativity are found only in some cultures (e.g., Matud, Rodríguez, & Grande, 2007; Archer et al., 2013; Shen, Liu, Shi, & Yuan, 2015), school education seems to have a decisive influence (Csikszentmihalyi, 2000). Creativity is supposed to keep a balance between fear and boredom, which may explain the evolutionary advantage of creativity (Csikszentmihalyi, 2000): When people face a new problem, they experimented with solutions, maintaining the balance between mindfulness and risk to survive. With this evolutionary background in mind, it becomes evident that the archetype of human creativity is the problem-solving ability that needs security for its unfolding. For creativity, attitude is regarded as essential. Both the creative person and his/her social environment need a great deal of openness to the process of generating ideas. Creativity needs a secure environment offering space for self-regulation and self-responsibility to support self-efficacy, whereas these as part of a competence promoting learning environment are well known to foster learning (Sadeh & Zion, 2009; Franklin, Xiang, Collett, Rhoads, & Osborn, 2015; Schmid & Bogner, 2015; Conradty & Bogner, 2016).

Digital competence: Digital competence for sure is another channel which needs consideration and inclusion. As "digital natives" (DN) are defined as people who were raised during the cyber age (Prensky 2001), Prensky suggests an upbringing with digital elements in everyday life shaped our current generation how to learn, work, communicate and interact with others. However, researchers like Støle (2018) point out that we are using digital methods in schools already, yet never assessed whether students are equipped with the necessary skills to use them properly. Florjančič und Wiechetek (2019) add that passively learning 21st century skills is insufficient to successfully reach skill levels necessary to compete in the international job market. When teaching methods only consider non-digital natives and their learning processes, it seems inevitable that DNs cannot fully use their full learning capabilities. Therefore, Bagur-Femenías et al. (2020) recommended acknowledging digital nativity when teaching environmental issues. Brudermann et al. (2019) suggest that sustainability citizenship is the basis for young, ambitious students to be successful on an increasingly international job market. By implication, teachers must assess digital skills before they implement digital teaching methods into their syllabus. In the context of technology, sustainability citizenship is seen

as an important concept in cultivating political sensitivity to technology. It engages with the displacement of power through contestation, suggesting that technological citizenship is essentially sustainability citizenship (Valkenburg, 2012).

Social competence: Children learn active and responsible citizenship through opportunities to practise it – but this requires formal channels to incorporate children into school- and community-based programmes for evaluating, planning and caring for local environments (Louise Chawla (2002).

In summary, Sustainability citizenship is a multi-faceted concept that encompasses a range of competences along with practices and responsibilities aimed at promoting a sustainable future. It is a dynamic and evolving form of citizenship that is becoming increasingly relevant in the face of global environmental challenges. Table 1 summarises the overall Sustainability Citizenship Framework of competences.

2.3 Education for Sustainable Development: A Pathway to the Sustainability Citizenship

Education for Sustainable Development (ESD) is a transformative and holistic approach that plays a pivotal role in cultivating sustainability citizenship. It serves as a comprehensive educational framework, equipping learners with the knowledge, skills, attitudes, and values essential for shaping a sustainable future. ESD emphasises critical competences such as critical thinking, systems thinking, and participatory decision-making, all of which are integral for individuals to function effectively as members of both their local communities and the global society. The interconnection between ESD and sustainability citizenship is well-documented in the literature. For instance, the UN Decade for ESD has been pivotal in shaping science education to develop responsible citizens who promote sustainable development (Eilks, 2015).

The **connection** between ESD and sustainability citizenship is deeply rooted in the need to educate responsible citizens who understand the complexities of environmental, economic, and social systems. This is achieved through a multi-faceted educational pathway. Firstly, it involves imparting a comprehensive understanding of complex sustainability challenges and fostering a deep knowledge base that is crucial for informed citizenship. Secondly, skills development is emphasised, promoting critical analysis, problem-solving, and systems thinking, which are vital for evaluating and contributing to sustainable practices. Thirdly, ESD nurtures values and attitudes supportive of sustainable development, including a commitment to equitable practices and a sense of responsibility towards both the environment and future generations.

Moreover, ESD stresses the importance of active participation and engagement in sustainable practices, advocating for involvement in shaping a sustainable society through local initiatives, political activism, or global movements. It seeks to empower individuals as agents of change, nurturing their ability to initiate and support sustainability efforts. The interdisciplinary nature of ESD, which draws on various subjects and perspectives, facilitates a comprehensive understanding of sustainability, promoting holistic thinking crucial for sustainability citizenship. ESD also encourages learners to understand and connect global issues with local actions, recognising their role in addressing global challenges.

By integrating these principles into educational curricula and pedagogies, ESD not only educates but also empowers learners to become proactive agents of change, embodying the principles of sustainability citizenship. This approach fosters a generation of individuals who are not only well-informed and skilled but also motivated to actively participate in the creation of a sustainable society. ESD, therefore, represents not just an academic endeavour but a platform for nurturing sustainable citizens ready to lead and support the transition towards a more sustainable world.

ESD provides a framework for education that aims to equip learners with the knowledge, skills, attitudes, and values necessary to shape a sustainable future. This framework emphasises the development of competences such as critical thinking, systems thinking, and participatory decision-making, which are essential for sustainability citizenship. Sustainability citizenship refers to the role of individuals as members of a community and a global society, where they actively engage in practices that contribute to the sustainability of the environment, economy, and society.

The link between ESD and sustainability citizenship is supported by extensive research that highlights the influential role of education in promoting a society dedicated to sustainability. The UN Decade for ESD has been pivotal in redefining science education, aiming to cultivate responsible citizens who are well-versed in the societal and professional implications of science. This redefinition is essential not only for career guidance in science and engineering but also for instilling a comprehensive understanding of science's role in society (Eilks, 2015).

The reorientation of teacher education is identified as a critical factor for the success of ESD. It is essential that educators are equipped to highlight the salient issues of sustainable development, such as systems thinking and citizen participation, to effectively nurture the next generation of responsible citizens (Ferguson et al., 2021). Moreover, ESD is characterized by the mastery of skills that are fundamental to sustainable development. These skills include, but are not limited to, foresight, critical thinking, systemic thinking, partnership building, and active involvement in decision-making processes (Zhang et al., 2020).

A significant educational transformation is necessary to advance science-based citizenship education that promotes sustainable development. Such an education encourages students to become agents of change, capable of transforming their local environments while maintaining a global perspective on environmental, social, and economic challenges (Bascopé et al., 2019). Furthermore, a democratically oriented ESD places a strong emphasis on participation, advocating for a historical and socio-cultural approach to engaging with sustainable development (Læssøe, 2010).

Curriculum development also plays a crucial role, particularly for middle and high school biology teachers, in enhancing their comprehension of the intricate interplay between environmental, economic, and social dimensions of sustainable development (Bezeljak et al., 2019). Additionally, e-learning emerges as a supportive tool in ESD, facilitating the transition to sustainable societal patterns by promoting the competences necessary for sustainability citizenship (Azeiteiro et al., 2015).

The initial idealistic vision for the Decade of ESD has evolved, with a more pragmatic focus on global education for sustainability citizenship being proposed as a realistic and achievable objective for future initiatives (Huckle & Wals, 2015). Collectively, these research findings highlight the critical importance of embedding ESD within educational curricula to nurture sustainability citizenship, characterized by proactive engagement in sustainable practices and informed decision-making that prioritizes the collective well-being of our environment, economy, and society.

ESD aims to equip learners with the knowledge, skills, attitudes, and values necessary to shape a sustainable future. It emphasizes competences such as critical thinking, systems thinking, and participatory decision-making. Sustainability citizenship, on the other hand, refers to the active engagement of individuals in practices that contribute to the sustainability of the environment, economy, and society. The educational project in question applies the concepts of ESD to achieve sustainability citizenship as a result, fostering a community of individuals who are well-informed, skilled, and motivated to make sustainable choices and to participate actively in the creation of a sustainable society. Furthermore, the reorientation of teacher education is crucial for ESD, ensuring that critical issues surrounding sustainable development, such as systems thinking and citizen participation, are emphasized (Ferguson et al., 2021). This is essential for cultivating educators who can instil the principles of sustainability citizenship in their students.

The mastery of ESD skills is also indicative of progress towards sustainability citizenship. Skills such as foresight, critical thinking, systemic thinking, building partnerships, and participating in decision-making are integral to ESD and are indicative of a sustainable citizen's capabilities (Zhang et al., 2020).

Moreover, ESD requires a transformation in educational systems to foster science-based citizenship education towards sustainable development. This transformation encourages agency from an early stage, enabling individuals to transform local contexts and create global awareness of the environmental, social, and economic challenges of the 21st Century (Bascopé et al., 2019).

Table 1. Sustainability Citizenship Competences.

Cognitive Domain (Ways of Thinking)	Intrapersonal Domain (Tools for Working and Living in the World):	Interpersonal Domain (Ways of Working and Living in the World):
• **Environmental Literacy**: Understanding environmental issues and their complexities.	• **Ethical and Values-Based Decision-Making**: Making decisions based on sustainability principles.	• **Civic Engagement**: Participating in community and civic sustainability activities.
Citizens need to have a fundamental understanding of environmental issues, including knowledge about ecosystems, resource conservation, pollution, climate change, and biodiversity. This knowledge helps individuals make informed decisions and take actions that reduce their environmental impact.	Sustainable citizens should base their decisions and actions on ethical principles, including respect for the environment, social justice, and responsible consumption. Ethical behaviour is at the core of sustainability.	Sustainability citizenship often involves active participation in civic and community activities related to sustainability. Citizens should be willing to engage in local and national initiatives, advocate for policy changes, and collaborate with others to address sustainability challenges.
• **Critical Thinking**: Evaluating sustainability challenges and solutions.	• **Resilience and Adaptability**: Adapting to evolving sustainability challenges.	• **Communication Skills**: Effectively conveying sustainability concepts.
Critical thinking skills are essential for evaluating complex sustainability challenges and potential solutions. Citizens should be able to analyse information critically, consider various perspectives, and make evidence-based decisions.	Sustainability challenges can be complex and evolving. Citizens should be adaptable and resilient, willing to learn, adjust, and persist in the face of obstacles and setbacks.	Effective communication is crucial for sustainability citizenship. Citizens should be able to articulate their views on sustainability issues and engage in constructive dialogues with others. They should also be able to communicate with policymakers, the media, and the broader public.
• **Systems Thinking**: Understanding the interconnectedness of systems.	• **Lifelong Learning**: Continuously updating knowledge and skills in sustainability.	• **Cultural Competence**: Appreciating diverse cultural perspectives in sustainability.
Citizens need to understand the interconnectedness of environmental, social, and economic systems. This systemic perspective allows them to recognize the far-reaching consequences of their choices and actions.	Sustainable citizens should embrace a mindset of lifelong learning, recognizing the need to stay informed about new sustainability developments and strategies.	Citizens should appreciate and respect diverse cultural perspectives, as sustainability is a global concern. Cultural competence helps individuals collaborate across boundaries and understand the cultural dimensions of sustainability.
• **Sustainability Literacy**: Interpreting sustainability-related information.		• **Advocacy and Leadership**: Leading sustainability initiatives and advocating for change.
Citizens should be able to read and interpret sustainability-related information, such as scientific reports, policy documents, and sustainability indicators. This literacy helps them stay informed and make data-driven decisions.		Sustainable citizens may need advocacy and leadership skills to champion sustainability initiatives and influence positive change in their communities and beyond.
• **Global Awareness**: Recognizing the global context of sustainability issues.		• **Community and Collective Action**: Collaborating with others on sustainability efforts.
While focusing on local sustainability efforts, citizens should also recognize their role in addressing global sustainability issues, such as climate change, biodiversity loss, and social inequalities.		Citizens should be open to working collaboratively with others to address sustainability challenges. This involves participating in community-based initiatives, joining organisations, and supporting collective actions.
• **Foresight**: Anticipating future scenarios and consequences.		
The ability to anticipate and critically evaluate potential consequences of actions, to apply this foresight in planning and decision-making processes and to plan for alternative future scenarios.		

Moreover, ESD requires a transformation in educational systems to foster science-based citizenship education towards sustainable development. This transformation encourages agency from an early stage, enabling individuals to transform local contexts and create global awareness of the environmental, social, and economic challenges of the 21st Century (Bascopé et al., 2019).

The educational project applies these principles by integrating ESD into its curriculum and pedagogy, aiming to transform learners into sustainable citizens. By doing so, it contributes to the broader goal of sustainable development, which is to meet the needs of the present without compromising the ability of future generations to meet their own needs.

By aligning the educational strategies with the goals of ESD, the project not only educates but also empowers learners to become agents of change in their communities, embodying the principles of sustainability citizenship.

2.4 Key Features of Sustainability Citizenship

In this section we are summarizing the Key Features of Sustainability Citizenship that are forming the basis for the development of the SYNAPSES Training Framework and of the criteria for the selection of SYNAPSES Best Practices :

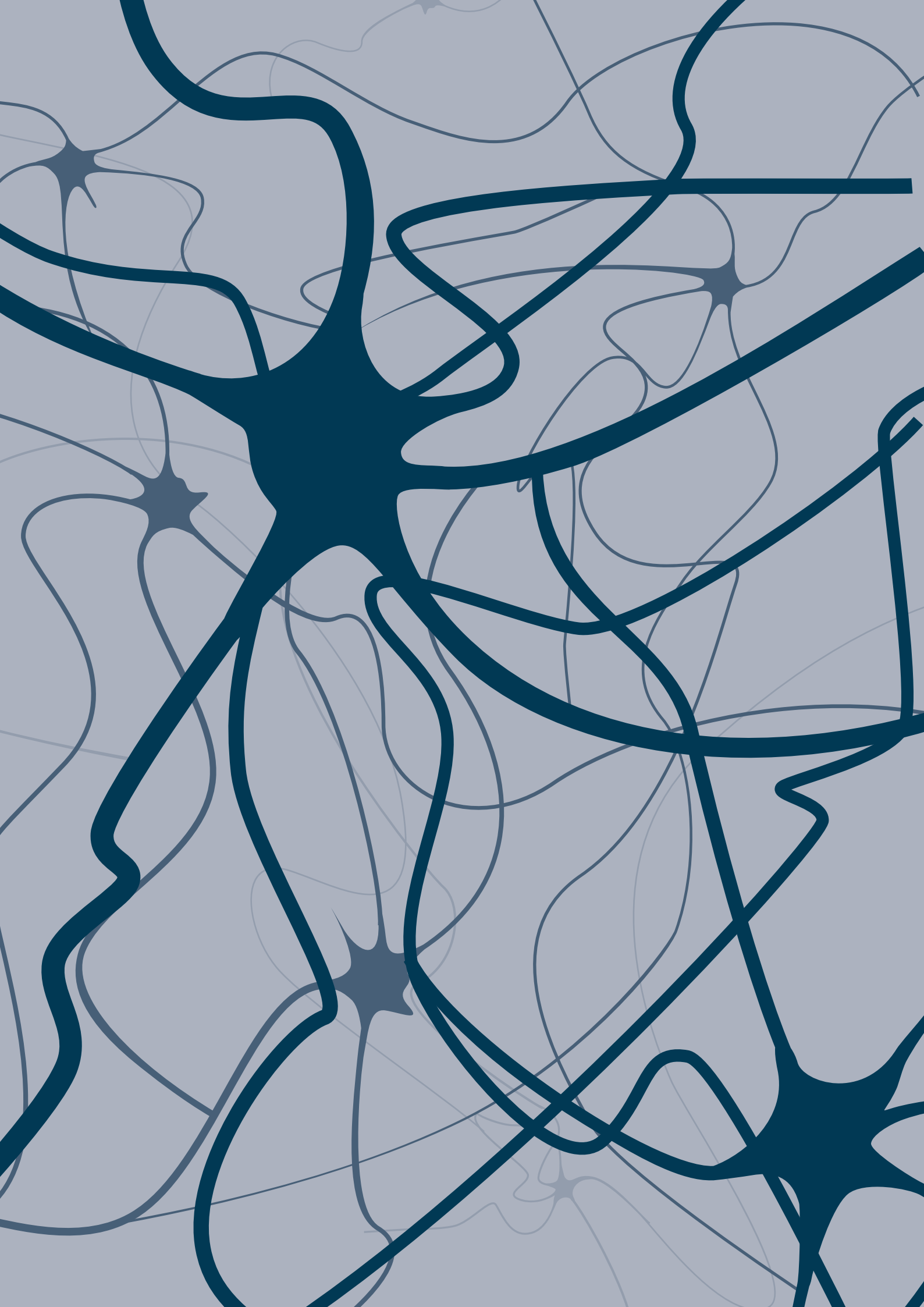
- **Recognition that sustainability is a common good that cannot be achieved by individual self-interest. The sustainability citizen is motivated by other-regarding motivations and not only self-interest. This attribute fits well into the self-enhancement – self-transcendence continuum of Schwartz's universal model of values, or the egoistic-humanistic-altruism (social altruism) divide described by Stern et al., 1993; Schultz, 2001; Dietz et al., 2005).**

- **In the context of behavioral change toward pro-environmental behavior: Belief that ethical and moral knowledge is as important as techno-scientific knowledge. Science and technology provide alternative solutions, but the decision which to choose is a normative one relevant to the specific social context. This attribute fits well with the increasing acknowledgement that 'technical optimism', as one of the perceptions that characterize the Dominant Social Paradigm of western societies (Dunlap, 2008), presents a barrier to achieving changes in consumption patterns and lifestyles (Kibert et al., 2012).**

- Recognition that **citizens have environmental responsibilities which derive from other people's environmental rights**. From an environmental perspective, every act conducted by the individual, since it entails use of environmental resources and production of waste, has public implications. Our personal ecological footprint (EF) contributes to environmental deterioration, thus the responsibility of SC is a matter of justice (and not charity): individuals or organizations that have a large EF have the duty to reduce their impact for the sake of those who occupy little ecological space. This includes the obligation to change institutional structures that underpin and reinforce injustice. Furthermore, these responsibilities transcend national boundaries and extend to distant places and peoples (since our EF goes beyond our country boundaries). Thus, SC reflects a global-citizenship perspective, both internationally and inter-generationally.

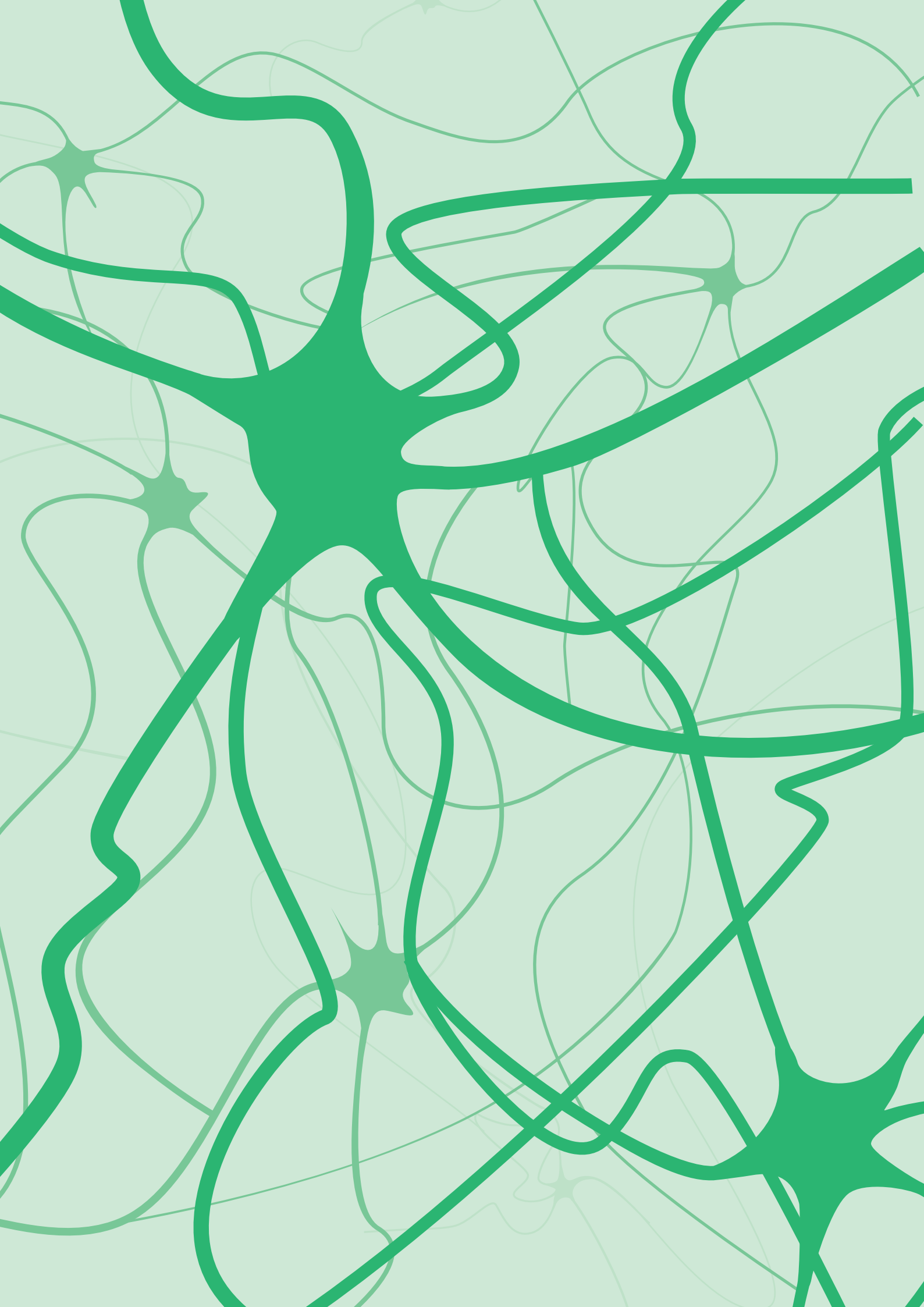
- Recognition that actions in the private sphere (homes) have public environment-related impacts – since our **'private' decisions have public environmental implications**, SC includes citizenship of the private sphere.

- Recognition that the government policy, as a catalyst for democratic change originating in civil society, can be reflected in expanding opportunities for citizen participation in policy-making and civic involvement, supporting grass-root initiatives, providing funding streams, building social capital, and no less importantly - promoting public debate on crucial ethical and normative issues that are at the heart of sustainability issues. (Barry, 2006; Dobson, 2007, 2011).



3

GREEN LEARNING ECOLOGIES: AN EDUCATIONAL ECOSYSTEM FOR THE DEVELOPMENT OF SUSTAINABILITY CITIZENSHIP



Green Learning Ecology refers to the development of a learning ecosystem that integrates environmental education with real-world, out-of-school learning experiences. It emphasizes the connections between formal education and informal learning settings, involving a wide range of stakeholders including educators, students, scientists, policy experts, and community members. This approach aims to foster a deeper understanding of environmental issues, promote sustainability citizenship, and support the development of resilient social-ecological systems. By drawing on socio-cultural learning theory and frameworks from ecological research, Green Learning Ecology seeks to create a learning ecosystem that encourages active engagement with environmental challenges, facilitates the building of social capital, enhances ecosystem services, and prepares individuals for future opportunities in personal, academic, professional, and civic realms. The concept is full in line with released the OECD landmark report *Back to the Future of Education: Four Scenarios for Schooling*[3] to support long-term strategic thinking in education. Building on the ground-breaking 2001 *OECD Schooling for Tomorrow* scenarios[4], the report states that "*in a complex and quickly changing world, this might require the re-organisation of formal and informal learning environments, and reimagining education content and delivery.*" (see Figure 4). Green Learning Ecologies support this re-organisation of the learning environments – focusing on Schools as Learning Hubs and on Learning as You Go OECD scenarios for the future of schooling. In this chapter we will document why the Learning Ecologies are offering the context of implementation for the development of SC.

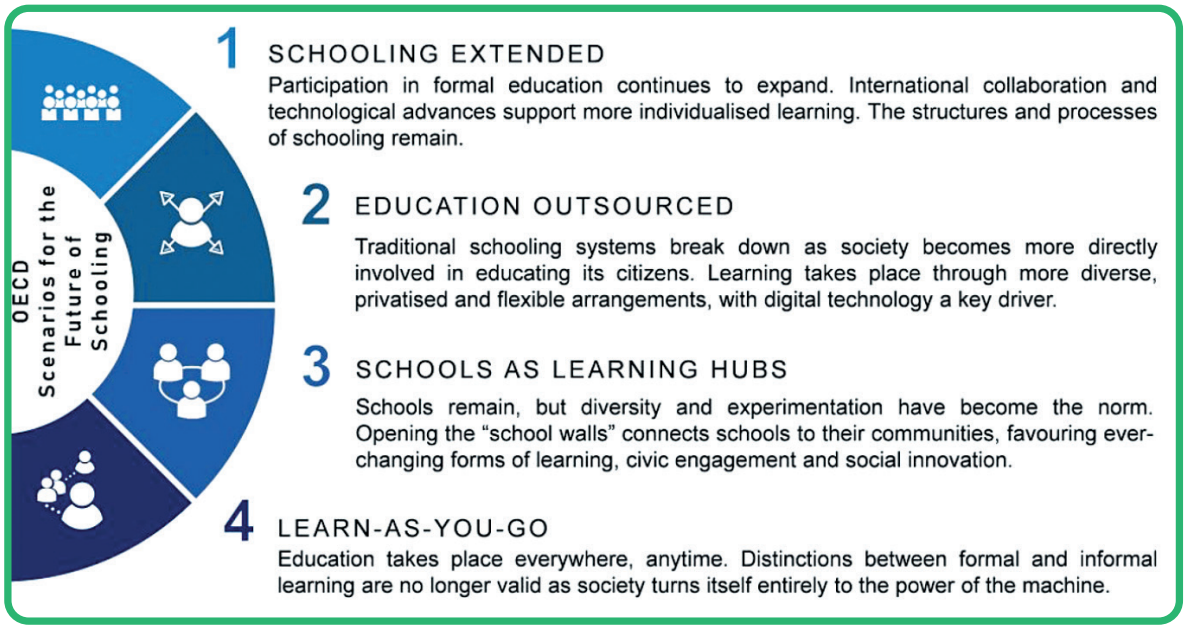


Figure 4. ***Back to the Future of Education: Four OECD Scenarios for Schooling, OECD Publishing, Paris. Source: OECD (2020)***

[3] Back to the Future of Education: Four OECD Scenarios for Schooling | en | OECD
[4] What Schools for the Future? | Schooling for Tomorrow | OECD iLibrary (oecd-ilibrary.org)

3.1 Learning Ecologies

To understand and value the world we live in, we need to understand our natural environment, our responsibility for maintaining it by instilling an environmental awareness that leads to a shared sense of SC. Young people should early on understand the role and impact they have by participating in hands-on activities addressing an environmental challenge in their community. Even more, we need to connect the learning of basic competences and skills with a deeper sense of responsible citizenship, coupled with and based upon scientific knowledge and an understanding that altogether provides meaning to information. Only this way, young people will learn to value data-based information, solve problems, make educated decisions, and take advantage of opportunities. Without the ability to critically evaluate information, scientific concepts can be misunderstood, and pseudo-scientific reasoning can mislead people – such as climate-change deniers. Therefore, we need to help young people develop the necessary dispositions and become informed citizens capable of using their competences in science and technology wisely to solve the numerous global problems humans now face. The most recent example of this is the misinformation about the COVID-19 pandemic that can be found in popular media as well as the overall attitude of citizens towards the efforts of the scientific community to reduce the spread of the infections.

Formal schooling is one way people can learn about the existential environmental challenges the world is facing, but also about the solutions that science and society can offer. It is organised and guided by formal curricula focusing on the acquisition of domain knowledge and scientific skills leading to a formal accreditation such as a diploma or certificate. As stated in the report on "Rethinking education. Towards a Common global goal?" (UNESCO, 2015) the changes in the world today – and in specific the challenges of sustainability and preserving the environment - are characterised by new levels of complexity and contradiction. These changes generate tensions for which education systems are expected to prepare individuals and communities by giving them the capability to adapt and respond. Overcoming the complex societal challenges of today will require all citizens to have a better understanding of science and technology if they are to participate actively and responsibly in science-informed decision-making and knowledge-based innovation as it is stated in the recent report to the European Commission "Science Education for responsible citizenship" (EC, 2015) produced in 2015. While the central role of formal education is beyond doubt a significant part of competence development, skill acquisition and personal growth, one needs to acknowledge that a big part of learning takes place out-of-school. It results from daily activities related to family or leisure. In most cases, it is guided by curiosity or interest and leads to enjoyment. Particularly young people learn in diverse places as they grow up, for instance within their families, their communities, through the media, in after-school programmes, in the street. At the same time, they travel, and while they visit places like zoos, museums, and science centres. Sometimes – and ideally -, they are confronted with and learn about the same concepts and phenomena in different learning contexts. As a result, a significant challenge arises: How can we integrate the same concepts and phenomena they learn in these different contexts in a connected ecosystem?

While some research shows that people create links between different learning contexts[5,6], most of the literature points to a severe lack of contact between formal and informal learning contexts introducing the same concepts and phenomena[7,8]. As out-of-school learning experiences become more common in people's lives (considering the increased number of informal science learning initiatives available), it is crucial to facilitate stronger links and connections between the different learning settings and actors, that commonly are in the position to facilitate a "deeper learning" in environmental issues in formal education in combination with activities and partners outside the classroom. There is a unique opportunity to bridge the gap between the two worlds by developing an appropriate catalysing process: A connected learning ecosystem where young people may encounter a wide range of learning experiences and be supported by adults, scientists and policy experts, as well as peers in ways that could lead to future opportunities in personal, academic, professional, and civic realms. This vision requires educators and organisations to think beyond the bounds of their institutions to consider how collective action at the level of networks can provide opportunities and address inequalities in a way that more isolated efforts cannot. When discussing how youth might thrive in such an ecosystem—and what sort of interventions we can develop to help all youth do so—the idea of pathways[9] has often come up as a useful metaphor that invites us to consider youths' "learning lives" over time and across the many contexts (e.g., home, school, community organisations, science centres and museums, web and social media) where learning may occur.

While there are many ways to productively conceptualise such pathways, we simply invoke pathways as a metaphor for thinking about ways to provide structure to youth experiences – Learning Paths –, how they might "connect to" or "build upon" one another and thus allow a young person to pursue goals that require extended engagement or persistence across multiple contexts and learning opportunities. Learning paths take many forms influenced by emerging research and discoveries, changes in society's needs and interests, and changes in personal interests or opportunities. Some individuals describe their learning path as an upward trajectory, pointed towards a clear goal. Others describe their path as more irregular, resembling steps or, more often, an erratic bumpy line. Learning opportunities are made possible and shaped by the learning *ecology* that one inhabits. A Learning Ecology is the physical, social, and cultural context in which learning takes place. Like natural ecosystems, learning ecologies (see Figure 5) have physical dimensions, which may or may not include easy access to nature, science museums, or advanced science programmes or internships. However, we are less used to thinking about the sociocultural dimensions of learning ecologies.

[5] Eshach, H. 2007. Bridging In-school and Out-of-school Learning: Formal, Non-Formal, and Informal Education. Journal of Science Education and Technology 16, 171–190.
[6] Fallik, O., Rosenfeld, S. and Eylon, B. (2013). School and Out-of-School Science: A Model for Bridging the Gap. Studies in Science Education, 49:1, 69-91.
[7] Kim, M. & Dopico, E. (2016). Science education through informal education. Cultural Studies of Science Education, 11, 439-445.
[8] Leonard, S. N., Fitzgerald, R. N., Kohlhagen, S., & Johnson, M. W. (2017). Design principles as a bridge between contexts: From innovation in the science museum to transformation in formal education. EDeR. Educational Design Research, 1(1). https://doi.org/10.15460/eder.1.1.1059
[9] Sotiriou, S., Bybee, R., & Bogner, F. X. (2017). PATHWAYS – A Case of Large-Scale Implementation of Evidence-Based Practice in Scientific Inquiry-Based Science Education. International Journal of Higher Education, 6(2), 8–17. https://doi.org/10.5430/ijhe.v6n2p8.

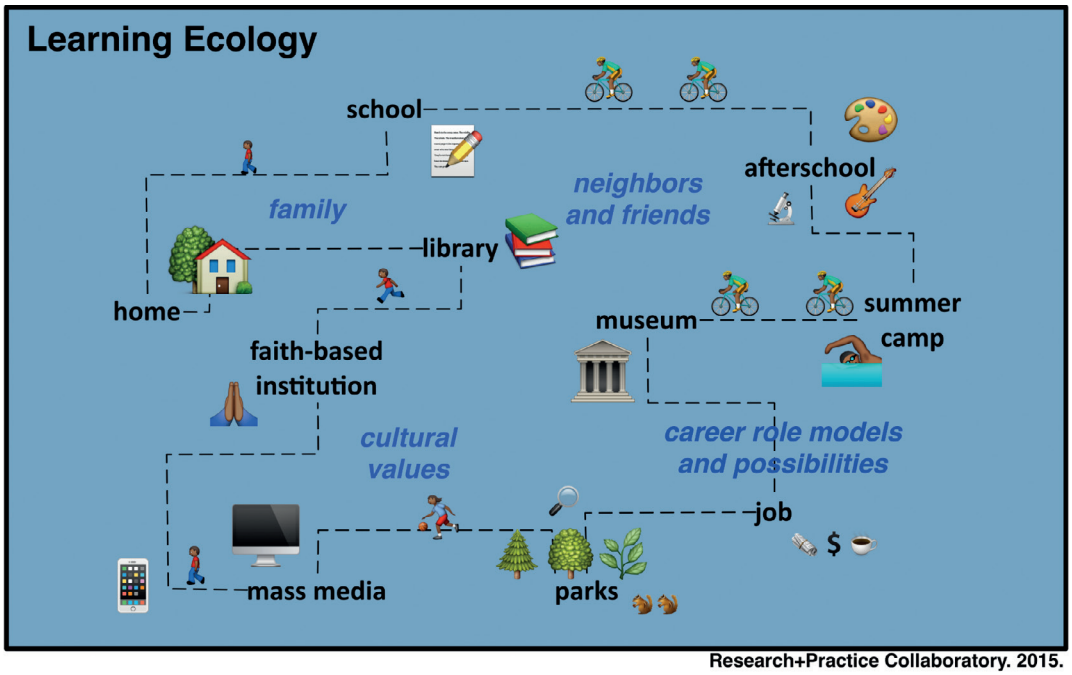


Figure 5. *A graphical representation of the Learning Ecology that describes the learning paths of individuals in the framework of school and out-of-school learning activities. By introducing the concept of Learning Ecologies, the SYNAPSES Academy has the ambition to design and set-up a strong training ecosystem. In such an ecosystem each piece is interconnected (with synapses) thanks to the common standard-based training framework that is proposed from the project.*

3.2 Open Schooling – A catalyst for the School Transformation

In the framework of SYNAPSES, Learning Ecologies are the contexts—the physical settings, social interactions, value systems and histories—in which teachers learn over time, both daily and during the lifespan. Like their natural counterparts, robust learning ecologies are characterised by diversity, redundancy, and local adaptations. This means that a robust learning ecology contains a wide variety of training programmes and opportunities, across a range of institutions and places, allowing teachers different and multiple ways to engage with environmental issues. Even more, this framework encourages individuals to take increasing levels of ownership over their own training as they gain more experience.

Nonetheless, such connected training ecosystem needs to be established and coordinated. It requires the cooperation and connection of collaborative partnerships, consisting of formal, non-formal and informal learning providers and stakeholders that can act as a key factor to optimise training opportunities across a range of institutions and organisations. Such collaborative networks exist in the form of Open Schools: The network of the OSOS schools (Open Schools for Open Societies - https://www.openschools.eu/) consist of established partnerships of institutions of formal and informal learning and provide a

perfect starting point to introduce the Learning Ecologies and bring them to life. The role of the school heads is critical for the realization of such partnerships.

Open Schooling[10]: where schools, in cooperation with other stakeholders, become agents of community well-being; the walls around schools come down but they remain strong, sharing responsibilities with other community bodies. Non-formal learning, collective tasks and intergenerational activities activities are strongly emphasised; school projects are revitalised around a knowledge agenda in cultures of experimentation, diversity, and innovation. It is an open system, welcoming approaches from potential external collaborators; The school scans its external environment to respond quickly to challenges and opportunities; families are encouraged to become real partners in school life and activities; professionals from enterprises and civil and wider society are actively be involved in bringing real-life projects to the classroom. Partnerships are based on equality of relationships and opportunities for mutual learning; Relevant policy makers encourage policy buy-in and the mainstreaming of good practices and insights into policies, and hence sustainability and impact. Such partnerships foster expertise, networking, sharing and applying science and technology research findings across different enterprises (e.g. start-ups, SMEs, larger corporations).

Another case of such collaborative frameworks involving different stakeholders around the educational organization is the open living lab (https://www.schoolsaslivinglabs.eu/).

[10] https://www.researchgate.net/publication/325284276_Open_Schooling_Roadmap_A_Guide_for_School_Leaders_and_Innovative_Teachers#fullTextFileContent

SCHOOLS AS LIVING LABS
SALL

The SALL aims to open-up schools to their local communities by transforming them in Living Labs. In this way, SALL proposes a new framework for schools across Europe to approach their science education programmes, in order to make STEM teaching more relevant, systemic and inclusive for their students, collaborating with their local ecosystems and research centres, and with the active support and involvement of science centres and museums in this process. SALL proposes the living lab methodology as a new technique of unique value and possibilities for the development of open schooling activities linked to science learning. SALL brings together school communities, including teachers, students and their families, research institutions, science museums and centres, spaces of informal learning and open innovation, as well as policy makers, and engages them in intensive dialogue and mutual learning and exchange.

These environments play a crucial role in creating opportunities for students' sustainability citizenship competence development in relation to pro-environmental behaviour (Cincera and Krajhanzl 2013)[11].

[11] Cincera, J., & Krajhanzl, J. 2013, 'Eco-Schools: what factors influence pupils' action competence for pro-environmental behaviour?', *Journal of Cleaner Production*, vol. 61, pp. 117–121.

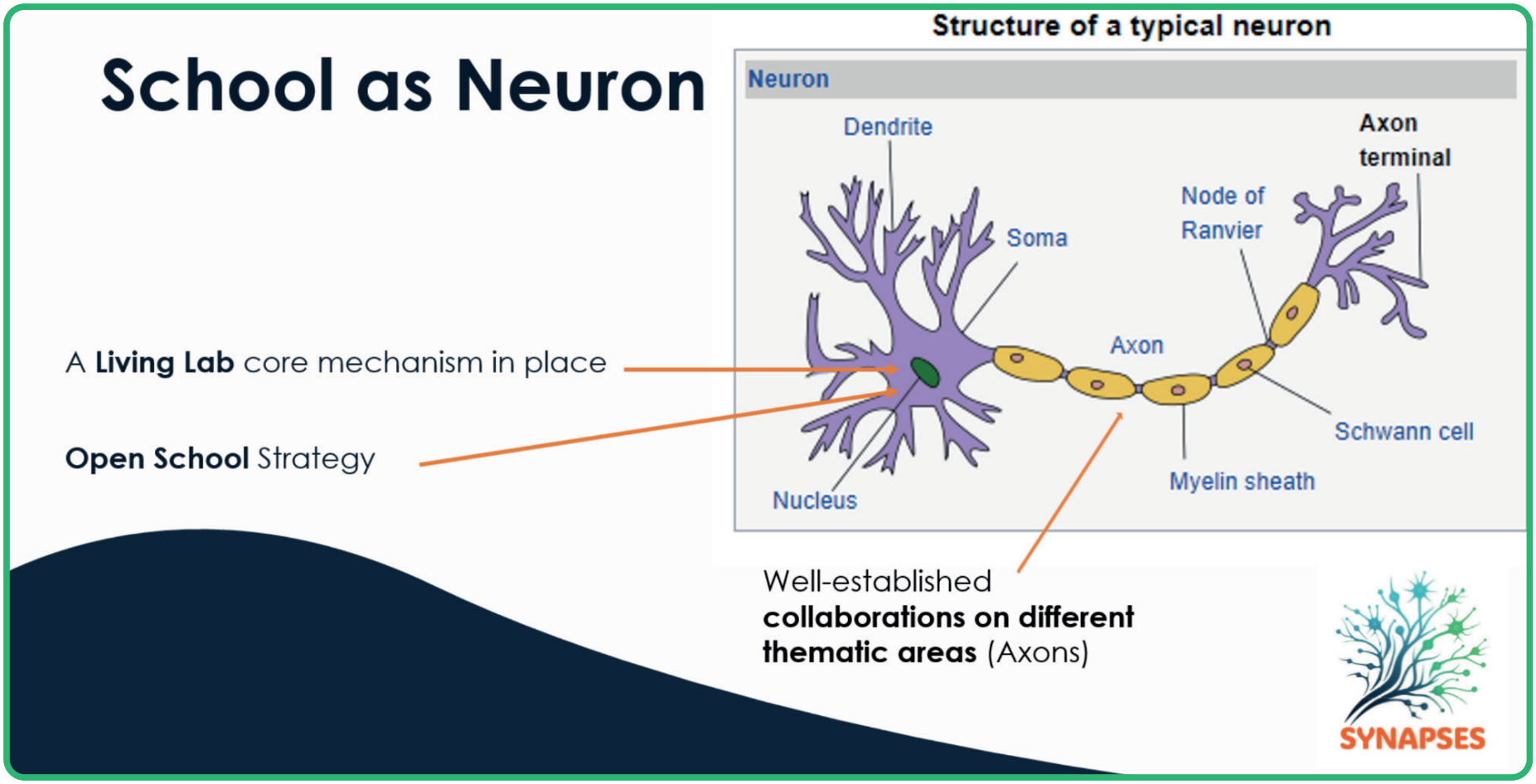


Figure 6. *School as a Living Lab for the development of Sustainability Citizenship competence. The standard-based training framework proposed by the SYNAPSES Academy will help school-heads and teachers to create a unique learning space (cell) that builds on the strengths of both formal and informal education by creating effective links (axons) with external stakeholders and real-life challenges that will offer to students personalised paths to sustainability citizenship. The different parts of this integrated learning space are interconnected with synapses. The graph represents the key role of a) the Living Lab methodology that forms the starting point for the design and implementation of projects informed from the EU policies related to climate change (e.g. sustainable food systems, energy efficient buildings, waste management), b) the open school strategy that extents schooling to informal learning settings and c) the synapses, the long term cooperation with external stakeholders that share responsibility for students learning*

While external factors may limit students' engagement with meaningful problem-solving and behaviour change outside of the classroom, open living lab environments offer proving grounds where students can see that knowledge can be applied in their daily lives. In such a way the open living labs approach could help teachers to develop their own competences in responding to climate change.

Practical Example: Green Awareness in Action–How Energy Conservation Action Forces on Environmental Knowledge, Values and Behaviour in Adolescents' School Life

One pioneering initiative, the GAIA project, exemplifies how Internet of Things (IoT) technology can be utilized to deepen students' engagement with sustainability. By integrating environmental monitoring and data analysis into educational activities, this project showcases the potential of ESD to provide a meaningful, action-based learning experience. This approach not only aligns with the overarching goals of ESD, which aim to prepare learners to tackle modern sustainability challenges but also demonstrates the practical application of digital tools in bridging the gap between environmental knowledge and actionable behavior. The GAIA project served as a prime example of how hands-on engagement with sustainability concepts can enhance students' connection to environmental issues and empower them with a sense of agency. The project's focus on enabling students to monitor and reduce their energy consumption through IoT devices illustrates the importance of integrating sustainability into daily life, a key aspect of ESD. Furthermore, the research highlights the significant role that values and motivation play in influencing environmental behaviors. Findings indicate that combining action and feedback methods with value-driven education can markedly improve students' environmental literacy. This comprehensive educational model, which weaves together knowledge, values, behaviors, and science motivation, presents a viable strategy for promoting SC[12], [13]. The evolving educational landscape, as demonstrated through recent studies, suggests a promising convergence of theory and practice. This approach is crucial for preparing learners to become informed, motivated, and effective environmental stewards, capable of navigating the complexities of sustainability challenges in the modern world.

[12] Maurer, M., Koulouris, P. & Bogner, F. X. (2020). Green Awareness in Action–How Energy Conservation Action Forces on Environmental Knowledge, Values and Behaviour in Adolescents' School Life. Sustainability 12, 955; https://doi.org/10.3390/su12030955

[13] Maurer, M., Bogner, F.X. (2021). Green Awareness in Action of Saving Energy in School Life: Modeling Environmental Literacy in Theory and Practice Experience. In: Lackner, M., Sajjadi, B., Chen, WY. (eds) Handbook of Climate Change Mitigation and Adaptation. Springer, New York, NY. https://doi.org/10.1007/978-1-4614-6431-0_157-1

3.3 Context of Implementation: Introducing a Whole School Approach for the Development of Sustainability Citizenship

This section presents a detailed analysis of the key pillars of the proposed approach highlighting the key opportunities and challenges for establishing the context of implementation for the development of SC. Furthermore, these sections examine how SYNAPSES intends to address the barriers and seize the opportunities for maximizing the effectiveness of the SYNAPSES Training Framework.

Whole School Approach (WSA), as the starting point of the development of Green Learning Ecologies to facilitate students learning, refers to a holistic, systemic, co-creative, and reflexive effort by all stakeholders involved in education to meaningfully engage students and in general, the school community in complex sustainability challenges. Holistic highlights the attempt to explore and address sustainability issues from multiple perspectives in an integrated and relational way. Systemic refers to considering key aspects of the education system simultaneously (formal, non-formal, and informal education, curriculum, pedagogies and learning, professional development, school-community relationships, school practices, vision, and leadership). Co - creative refers to the inclusion of multiple voices and stakeholders in the development of the approach within a given context either at a school or a policy level. At last, reflexive refers to the need for continuous learning, monitoring, evaluation, and re-calibration in response to an ever-changing world.

A WSA is a concept in which multiple themes can be simultaneously addressed within the overarching umbrella of sustainability or sustainable development, not by reducing them to "learning tasks", but as entry points to different ways of working and living, considering current global challenges (Mathie and Walls 2022). In this sense, this section provides an overview of how to transform schools to enablers of the WSA to tackle sustainability challenges, introduce innovative topics and pedagogies, foster innovation, and strengthen collaborative and participatory learning and planning. A whole-school and interdisciplinary approach that includes students, teachers, families, and the broader community can help to create a cultural shift towards a more sustainable future (Borgonovi et al. 2022). Hence, the creation of continuous learning paths that begin in primary education through to secondary and higher education is of paramount importance to ensure that young people are prepared to meet future sustainability challenges.

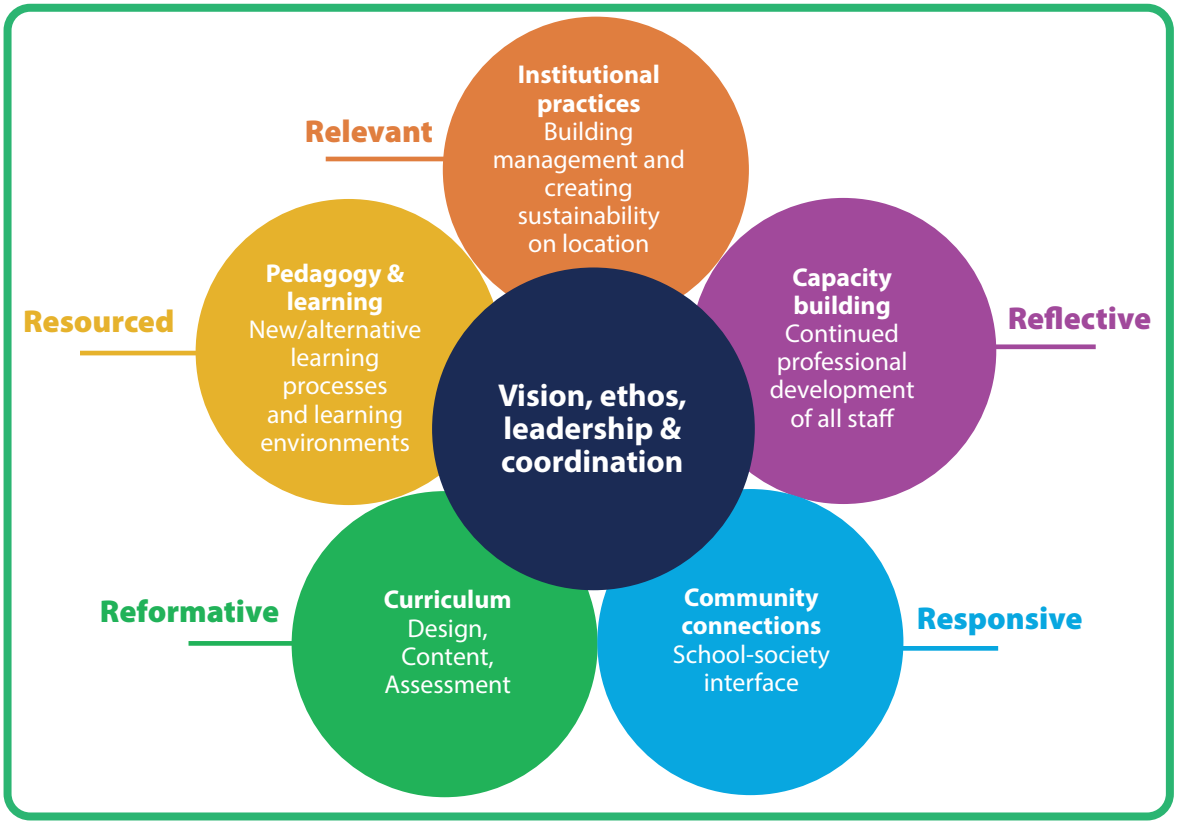


Figure 7. *The key pillars for the development of the SYNAPSES Training Framework. They highlight the key opportunities and challenges for establishing the context of implementation for the development of SC.*

The SYNAPSES Framework has set as a priority to engage school heads and teachers to a WSA as the path towards the development of SC. Such an approach should be (see Figure 8):

- **Relevant** to the school's mission; national educational priorities; community identity; as well as localised to the environmental priorities and regional needs.
- **Resourced** with expertise and support in sustainability and learning for sustainability; physical resources and technologies to make the transition; and medium-term financing opportunities to execute plans.
- **Reflective** by capacity building, critical reflection and evaluation at all levels; develop critical thinking, digital and sustainability competences in its staff and students; striving to become a learning organisation.
- **Responsive** by embracing a flexible structure and adapting to local and cultural settings; teachers and students develop the capabilities to recognise complexity as well as the changing nature of sustainability challenges and reject a one size fits all approach to sustainability. and students develop the capabilities to recognise complexity as well as the changing nature of sustainability challenges and reject a one size fits all approach to sustainability.
- **Reformative** which means that the agenda is not simply one of adding environmental or SDG themes to the curriculum but involves reframing the entire educational experience to support the overall learning ecology

Figure 8. *School as a Living Lab for the development of Sustainability Citizenship competence. Whole School Approach, as the starting point of the development of Green Learning Ecologies to facilitate students learning, refers to a holistic, systemic, co-creative, and reflexive effort by all stakeholders involved in education to meaningfully engage students and in general, the school community in complex sustainability challenges related with the Key EU policies in the field (e.g. sustainable food systems, energy efficient buildings, waste management).*

Vision and Leadership

The vision and leadership of a school within the WSA plays a crucial role in promoting SC and practices. Such a vision emphasizes the recognition of the school as a hub for fostering connections between students, educators, and the natural world. By providing transformative learning experiences grounded in nature, the school cultivates a sense of responsibility and respect for the environment. The leadership of the school ensures the implementation of comprehensive policies and practices that prioritize SC, such as integrating nature and biodiversity topics into the curriculum, enhancing outdoor learning activities, and engaging with the local community to create a holistic and impactful educational environment. To achieve this vision, the school's leadership must focus on integrating sustainability issues and challenges into various aspects of school life. The leadership encourages teachers to incorporate nature-centered activities and field trips into the curriculum, fostering a deeper understanding of ecological systems and inspiring students to become eco-literate citizens. By creating opportunities for experiential learning, the school nurtures a sense of agency and empowerment among students. School principals and overall, the school administration play a pivotal role in fostering SC within their schools. They are responsible for establishing a collective vision that promotes a participatory process to engage the school community and external stakeholders. Moreover, principals need to prioritize the integration of the key features of SC into the daily life of the school, ensuring that sustainability practices are embedded in various aspects of the school's operations. The school's vision and effective leadership also play a crucial role in forging partnerships, the school not only benefits from external expertise but also creates a broader impact by spreading awareness and inspiring change beyond its immediate sphere. The leadership also allocates resources to improve the school's infrastructure, incorporating green technologies and renovation projects. Through these proactive measures and collaborative efforts, the school demonstrates its dedication to cultivating a sustainable and nature-centered learning environment. We highlight the strengths and the challenges of the approach:

Strengths

- The existence of a powerful and convincing political vision and a structured legal framework.
- The existence of supportive management and long-standing school culture.
- The existence of strong leadership, vision, and sustainability coordinators.
- The ability to invest in sustainable solutions and funding opportunities and to seek external expertise where needed.
- The presence of consultation processes involving diverse groups of education stakeholders.

Challenges

- The teachers do not necessarily believe in its ethos or sustainability approach.
- Lack of support by national educational authorities to face the unique challenges.
- Finding staff who want to take on the coordination role.

SYNAPSES Academy aims at promoting a clear, long-term, and innovative vision for school-heads and teachers. Through Visionary Workshops, engagement with school principals, expert teachers, and a focus on co – design and futures thinking approaches, the project team aims to build a strong and dynamic community of practice centered on teaching for SC. Organizing these activities at a local and international level shows an understanding of the importance of context and local relevance and this aspect is vital in ensuring that the Vision pillar aligns with the unique needs and characteristics of each community.

Community Connections

The process of supporting teachers in forming school partnerships with external societal actors to enhance the implementation of SYNAPSES Academy activities raises questions such as:

- How are schools establishing partnerships with local environmental organizations, governmental and policy-making agencies, local businesses, NGOs, and universities to foster collaborations and access expertise, resources, and funding opportunities?
- How is networking and knowledge sharing encouraged among schools where teaching for SC is the norm or those that are just entering the transformation journey?

The answers are grounded on the Living Lab methodology and how schools can be transformed into initiators of co - creation and participatory processes or even prototypes of new ideas and concepts. Thus, the design principles and practices that constitute a potential field for creative innovation and support for promising initiatives on sustainability, offering competences, abilities, methodologies, and a unique viewpoint. Weighting in the "co-creative" aspects, we are focusing on an environment that aims to facilitate co-creation as an interactive scheme for collaborative research where multiple users play an active role. In this context, design-based participatory processes are suited to support youth development and empowerment as long as they: i) provide spaces for experimentation, inviting youth to reflect and enact choices in a non-serious, playful environment; ii) offer opportunities for peer interaction, equal participation with adults, exploration of diverse identities, and elaboration of possible futures; iii) improve youth's ability to understand and contribute to (trans)forming their life contexts, exercising skills for active participation and positive intervention. In the 'Schools as Living Labs' (SALL[14]) project the Living Lab approach is proposed as a new technique for the development of open schooling activities linked to the development of proficiency in science. The methodology used to support the collaboration among different partners who want to address a concrete issue relevant for each of them, typically comprising of the following phases:

1. **Co – creation** and analysis including identifying needs, defining issues and coming up with ideas and a real solution, making use of the participants' personal experience,

[14] https://www.schoolsaslivinglabs.eu/

2. Exploration and quick prototyping, as ideas are immediately put into practice and tested,
3. Experimentation by testing the prototype or scenario of the solution in real life and finally,
4. Evaluation by analysing the results of the experimentation to validate or improve the solution.

In the phases mentioned above, the central players are the school communities by initiating and participating in the co – design processes. Thus, schools were systematically engaged in the work of a project, involving students, teachers, and students' families in the processes of dialogue, mutual learning, and co-construction. As revealed from the project outcomes, teachers were more involved in the project planning and conceptualization process and more eager to express and reflect on aspects (of internal and external origin) that could facilitate or hinder the successful implementation of their school project. However, some concerns are noticed about the actual practicability of such efforts. In particular, the Living Lab approach consists of an ideal scheme to introduce such initiatives and actions nevertheless, the success of these approaches is dependent on effective communication, collaboration, and engagement of all stakeholders with the school community, which can be challenging in a complex and diverse educational setting. Overcoming these barriers will require a concerted effort from all education stakeholders, including teachers, students, parents, and policymakers, to support the adoption and implementation. We highlight the strengths and the challenges of the approach:

Strengths

- The presence of experienced and flexible staff: professionals who embrace projects.
- The support of the local community in the school's environmental projects.
- Successful collaborations with national and international organisations to provide an interactive and dynamic platform to the students.
- The existence of extra-curricular partners, out-of-school learning spaces.
- The financial support from partner municipalities and directorates
- The creation of learning communities, linked by common goals in an informal and friendly atmosphere.
- Fostering extroversion through the involvement of external experts in environmental activities that encourages pupils to evaluate the information given to them.

Challenges

- Lack of community engagement due to time constrains and limited resources.
- Collaborating with the local community and various stakeholders can be challenging, expensive, and time - consuming.
- Community motivation and budget constraints.
- Complexities of mobilizing a highly pluricultural community with different languages and perspectives.
- When referring to infrastructure maintenance, there is a lack of budget and personnel to support maintenance activities.

Grounded on the Schools as Living Labs methodology SYNAPSES Academy will provide a real - world context for numerous environmental challenges. In this way, the school community, including students, teachers, staff, parents, and local stakeholders, will collaborate in co - designing and developing hands- and mind- on projects that promote SC. Inclusivity ensures

that diverse perspectives will be considered through the co – design processes, leading to more well - rounded and student/community - driven solutions. This process will be facilitated through the offer of numerous Best Practices (projects and activities that will be selected by the consortium partners) that will populate the SYNAPSES Academy Community Platform.

Institutional Practices

Institutional practices
Building management and creating sustainability on location

The potential opportunities of linking teaching for SC to the physical and technical infrastructure and daily operations of the school are many and include the transformation of the school building and the schoolyards to a sustainable, inclusive, and beautiful learning space to teach different concepts. Focusing on SC, the installation of green roofs, rainwater harvesting systems, green shady structures, tree planting, and overall, the school yard reconstruction, the energy efficiency of the building, the use of renewable resources and other related installations can encompass the engagement of the entire school and local community taking advantage of the Living Lab methodology.

Figure 9. ***Renewable Energy Labs can be used to transform school buildings to living labs.***

Examples of activities that support the development of Sustainability Citizenship in Schools: a) Solar Power Lab on the roof of the school building offers a new concept of inquiry learning related with the school infrastructure. b) Using interactive energy dashboards, students can experience the energy-efficient features and the varying conditions of season and weather. The dashboard gives students a synergistic view of how the schools site operates as an integrated system of which they are an essential component. Schools can be transformed to laboratories that promote sustainability citizenship.

According to the "FIT FOR 55" legislative package[15], that transposes this European Climate law[16] into the national regulations, a European renovation wave that will concern almost all

[15] https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/delivering-european-green-deal_en
[16] https://ec.europa.eu/clima/eu-action/european-green-deal/european-climate-law_en

existing buildings will be imposed. Such renovations have already occurred in different European countries. In terms of sustainability, these plans are targeting a change of attitude in three dimensions:

- **Restoring nature**: So that we are prepared for rising temperatures, heat waves/storms, seasonal water shortages with a smart adaptation of the urban environment,
- **Increasing Environmental Handprint:** This will lead to profound behavioural change (knowledge, offers, and habits), with an increasing need for lifelong learning involving three generations working together to achieve sustainable global performance,
- **Footprint reduction:** Transitioning to reduced emissions, waste reduction and renewable energy is one of the most powerful ways for countries to reduce their Ecological Footprint with qualitative retrofitting and renovation in a circular approach,

Highlighting these dimensions, the creation of increased environmental handprint and decreased carbon footprint educational facilities, such as schools, universities, or science centers, involves a process that can promote formal, non-formal, and informal learning, foster healthy and high-performing learning environments, ensure responsible fiscal management of community resources, and showcase sustainability leadership by reducing the impact of the built environment. To this end, educational spaces hold great potential as innovation incubators and catalysts for sustainable design that is both attractive and affordable to everyone. The overarching goal of such actions is to engage students in the planning, co-design, monitoring, and renovation processes by collaborating with external experts, researchers, and different societal actors to promote the school's vision. Building on these ideas, it has been agreed upon more recently that the right spatial articulation in schools offers the opportunity for hosting different activities. Education is a constantly evolving field with changes in pedagogy, technology, instructional programs, and enrolment, making it necessary for educational environments to be adaptable to constant change with minimal disruption and cost. Thus, these school environments will be able to showcase innovative approaches and solutions, with the common goal of creating a school that promotes inquiry and challenge-based learning and a sense of ownership among students and building stakeholders. Potential opportunities and challenges that are noticed are:

Strengths

- The meaningful participation of students in decision-making about school life and their involvement in community-based decisions and actions.
- The staff realisation of the importance of "unlearning" the deeply ingrained habits and expectations that stand in the way of sustainability.
- The long-term core staff members and long-term commitment to sustainability-oriented education.
- The cultivation of students' innovative literacy and financial and economic literacy linked to entrepreneurial skills.

Challenges

- The uneven commitment by members of the educational team: due to national educational policies, teachers rotate and therefore there may be an unstable team.

- The different sustainability issues that the schools in depopulated or rural areas are facing from those in urban areas even though are rich in nature and have strong human ties.
- The time and money that is needed.
- The risk of greenwashing or the seeking of certification more as a label of merit rather than a way to promote real transformative changes at an organisational level.

The SYNAPSES Academy will integrate in its syllabus such sustainable practices, opportunities for outdoor education, and student involvement in decision – making. Projects related to school building renovation projects, school gardens, green roofs, vertical gardens, pocket and biodiversity parks, and rainwater management concepts will be enhanced by community projects linked to disaster risk management, ecosystem services, and forest management. The SYNAPSES platform will be populated with numerous projects and activities that foster ecological awareness, critical thinking, and a deeper understanding of sustainability principles inside and outside school.

Pedagogy and Learning

SYNAPSES Academy will promote the introduction of Challenge Based Learning (CBL) in school settings. CBL provides an efficient and effective framework for learning while solving real-world challenges. The framework fuels collaboration to identify big ideas, ask thoughtful questions, and identify, investigate, and solve challenges. CBL helps students gain deep subject area knowledge and develop the skills necessary to thrive in an ever-changing world. It must be noted that Critical reflection is fundamental to transformative learning, which invokes processes of reconstructing knowledge based on life experiences and arriving at new ways of thinking and being. The main practices and conditions essential for fostering transformative learning towards SC development must incorporate:

- A safe and trustworthy learning environment that is democratic and open and that promotes critical reflection and critical thinking.
- Experiential learning opportunities and linking formal and non-formal education.
- Learner-centered approaches to promote student autonomy.
- Feedback and self-assessment by 'facilitators' to participants, by participants to participants, and by participants to facilitators.
- Appropriate facilitator characteristics, e.g., trustworthy, empathetic, authentic, caring, and sincere.
- The adoption of the cultural background of the participants in the school community.

The pedagogical approaches needed to achieve this end should be learner-centred, action-oriented, and transformative. While such pedagogical approaches describe the general character or guiding principles for designing learning processes, specific approaches, and tools, in line with these principles, are still needed to facilitate the learning process:

- Collaborative real-world projects, such as a service-learning project and challenges for different sustainability topics.

- Vision-building exercises, such as future workshops, scenario analyses, utopian/dystopian storytelling, science-fiction thinking, and fore and back – casting.
- Analysis of complex systems including community-based research projects, case studies, stakeholder analysis, actor analysis, modelling, and systems games.
- Critical and reflective thinking including through fish-bowl discussions and reflective journals.

When teaching and learning methods for a specific setting or topic are chosen, they have to match the needs of the learner group (e.g., based on age, prior knowledge, interests, and abilities), the context in which the learning takes place (e.g., space in the curriculum, pedagogical climate, and cultural traditions), and the resources and support available (e.g., teacher competences, teaching materials, technology and/or funding opportunities). The strengths and the challenges occurring in implementing such pedagogies are defined as:

Strengths

- The location of the school (e.g., urban, rural) which facilitates students to work outside and connect with nature.
- The real-life challenges and roles that are given to students.
- The raising students' enthusiasm to study with diverse learning methods and learning environments.
- The opportunity to integrate STEAM courses, citizen science projects, action research, cooperative learning, and storytelling into regular classes.
- The exploration of different ways in which students can individually or collectively take action to address sustainability issues in practical ways.

Challenges

- To engage every teacher in the school and ensure that sustainability is implemented in different disciplines.
- The lack of significant pedagogical freedom for teachers.
- To engage students with topics that are not familiar to them, i.e., agriculture and school gardens.
- To keep track of all the progress and have a clear action plan when there is so much going on throughout multiple aspects of the school.
- To build up hands-on experience for learners to understand problems and develop solutions especially when there is a lack of teachers' confidence.
- The time needed for the preparation of new educational materials.
- Changing attitudes and social behaviours is a long-term effort that needs to bring students, parents, and teachers together.
- The different learning styles of the students. Different tasks that suit and empower each student individually should be considered.
- Lack of teachers' knowledge and confidence to teach using these methods and approaches.

Through the introduction of challenge-based learning the SYNAPSES Academy aims to prsent to teachers ways to engage the students' mind, body, heart, and soul in a holistic learning experience.

Since the heart of the proposed open schooling approach, will be the process where the students 'feel' the problems and the needs of their school and the local community, the focus of the sustainability realted activities is on creating a pedagogical atmosphere of creativity, curiosity, collaboration, participation, and democracy. In this sense, the philosophy of "head, heart, and hands" will guide the educational approach, ensuring a balanced integration of knowledge, emotions, and practical skills. Hence, through place-based, experiential, and inquiry – based approaches the school grounds and public spaces are transformed into dynamic classrooms, offering hands – and minds - on experiences fostering a deeper connection to the environment.

Curriculum

In the classroom environment that promotes the development of SC, school curriculum should be much more than just a list of topics split in different subject domains. It should reflect the vision of the school for the learning experience of the students, an aggregate of knowledge content and practice intended to support a seamless acquisition of key skills and attitudes with a concrete set of goals towards their integration as valuable members of their community. Curriculum should be organized not as standard set of disciplines but as an integration of the different domains under a common umbrella. Curriculum should be flexible to accommodate, in general, the different socio-cultural environment and particularly each student's specific needs. Cross-disciplinary connections should be established taking all these characteristics as a starting point and building towards an aggregate of different experiences where students will understand the natural world and acquire the necessary competences to thrive in this rapid changing era. Part of the solution to these problems is to conceive the goals of ESD not in terms of the knowledge of a body of facts and theories but a progression towards key ideas which together enable understanding of events and phenomena of relevance to students' lives during and beyond their school years. The mode of communication is crucial if we are to convey the links between ideas and experience, which is better preserved in narrative form than in a list of disconnected points. It is important also to show how the key ideas have their roots in students' early explorations so that teachers, even if not the students, are aware of the contribution of these activities to a developing picture of the scientific aspects of the world around.

It is not only ESD than can be improved by anchoring facts and figures to unfolding themes. Historians are calling for specific events to be linked to narratives; similarly, there is a strong case for bringing together ideas from studying different phenomena in geography. The same could be said of many domains of knowledge, which exist as domains by virtue of possessing a core of knowledge, skills and attitudes but where, as in the case of science, the nature of this core is not made explicit.

There can be no doubt that a reason for the current fragmentation of students' learning experiences in many domains is to be found in the form of assessment that is used. Conventional tests and examinations ask a series of disconnected questions which inevitably

represent a selection, from the possible range, of those questions which can be reliably scored. Not surprisingly this encourages teaching of disconnected items of knowledge and how to give the 'right' answers. Further, the use of the results of assessment for high stakes decisions affecting students and teachers has implications for what is assessed and how. When students and teachers are being judged on results of tests or examination, there is a premium on accuracy that leads to restricting what is included to learning outcomes where performance can be most easily marked as correct or incorrect. This tends to exclude outcomes that are more difficult to judge unequivocally as right or wrong, such as application of concepts, reasoning, understanding (as opposed to factual knowledge) and attitudes that are likely to influence future learning. Although some of the outcomes that are difficult to include in formal written examinations can be assessed through projects or course work, high stakes pressure leads to a narrow focus in such work on the aspects that are reflected in the assessment criteria. This "disease" spreads to the primary school when testing is frequent and is used as a measure of teachers' or schools' performance. In extreme, this results in what is taught being determined by what is assessed rather than by what is of value in adding to a growing understanding of key ideas and development of reasoning skills and attitudes. It causes teachers to teach in a way that neither pleases them nor satisfies their students.

Unfortunately, policies of frequent external testing of all students persist, despite two decades of research which has given evidence of their negative impact and refuted the claim that "testing raises standards". However, it is not our purpose here to discuss further issues relating to assessment of students' achievement nor the related matter of how to evaluate the effectiveness of schools, except to point out that it is high time for considerable investment in developing new approaches to assessment that better reflect key ideas and skills in all subject domains.

Recent actions to reverse students' lack of interest in and enjoyment of science have focused on the approach to teaching. An inquiry-based approach is widely advocated and is being implemented in many different countries across the globe. Inquiry, well executed, leads to understanding and makes provision for regular reflection on what has been learned, so that new ideas are seen to be developed from earlier ones. It also involves students working in a way like that of scientists, developing their understanding by collecting and using evidence to test ways of explaining the phenomena they are studying. There is growing evidence that this has a positive influence on attitudes to science. However, it is optimistic to assume that change in pedagogy can be brought about without changing content or the curriculum. Inquiry-based teaching is demanding, both of teachers' skill and of time for teaching and learning. Inquiry-based learning can lead to greater depth in understanding but as it takes more time the corollary is that the breadth must be reduced. Thus, focusing on the key features of SC is a natural, and indeed necessary, accompaniment to promoting inquiry-based learning. The strengths and the challenges occurring in implementing such pedagogies are defined as:

Strengths

- The connection of the curriculum to the SDGs and GreenComp Framework offers an immense opportunity for inquiry-based learning.

- The raising interest in the field of ESD.
- The unique and well-documented learning outcomes of the inquiry process

Challenges

- The limitations of national curricula.
- Teachers' focus on curriculum delivery.
- The lack of assessment and accreditation structure in place.
- The lack of school autonomy.

Curriculum Content

By curriculum content we mean the topic or subject matter studied as a vehicle for students to achieve the ideas, skills and attitudes set out in a formal programme of study. Since there are numerous settings for the development of ideas about, for instance, renewable energy, food chains, or waste management, there must be some way of choosing among possible topics and activities. The principles in Section 3.4 imply some criteria for selection: activities should promote enjoyment of scientific activity; sustain curiosity; be seen by students as interesting and relevant to their lives; and of course, develop scientific understanding, capabilities, and attitudes. Further, a central part of the reason for SC is for students to experience how science enables us to understand how the world works.

Using content from the world around

Teachers generally instinctively recognise the need to capture the interest of their students and that this is best attempted through selecting content relating to a real or possible but hypothetical experience. Teachers of young children are expert at creating a story or an imagined situation as a setting for investigations – building a model house out of shoe boxes in the classroom as a context for exploring different materials that are used in real constructions or imagining how to keep warm on a cold and windy mountain as a reason for testing the insulating properties of different fabrics. For older students the pretence can be supplemented by real experience, through visits to power stations, water-treatment plants, recycling centres, etc. Not only can such visits motivate interest in how these essential services are provided, but they give students opportunity to see how science is applied in these processes.

Real world topics provide interest and motivation. The motivating link is important, particularly in an age where students have instant access to entertainment not only through television but also at any time on their mobile devices. But events and phenomena in the world around are usually too complex for students to be able to understand how they work by directly interacting with the actual events or phenomena. Although using real world contexts has many advantages – and there are certain phenomena that need to be studied in situ precisely because of the complexity – it can also be confusing. The considerable detail of actual events can obscure the characteristics that need to be identified to develop ideas that transfer to other settings.

Students need help in giving attention to the critical (as opposed to the irrelevant) features of a complex problem and it should not be assumed that they are able to identify underlying and applicable relationships for themselves. So, to avoid confusion of working only in the field, we take the essence of the problem into the classroom or laboratory where ideas can be more directly tested and developed. Whether the context that motivates engagement is a story or a visit, the science is learned in a simplified version of reality in the classroom or laboratory where conditions can be controlled, and variables measured.

In this process it is important not to lose the link to things in the world around. Unless the crucial link back into the "real" setting is maintained, there is a risk of the relevance of classroom-based activities being forgotten. So, there is a need for a balance between the richness and cognitive demands of too much information associated with real world contexts and study of specific selected aspects that help to make connections between different events and phenomena. Also important is regular discussion of how the findings of classroom inquiries are connected to the initial motivating context. Most significant for the development of bigger ideas are challenges to apply emerging ideas to new situations and to make connections with the ideas used to explain them.

Ways of engaging with content

There are some topics that are best addressed through investigation and inquiry whilst others re more appropriately presented as an account of a scientific discovery or discussion of experiments or findings of current topical interest. All of these should be included in the selection of content linked to the big ideas. It is important for students to have opportunities for discussing how some ideas have changed in the history of science and the reasons for these changes. Extending such discussion to students' own investigations helps students to recognise the role of evidence in the development of understanding, advancing their progress towards big ideas about the nature of science and its applications. This is further helped by discussion of how applications of science have led to developments in, for instance, medicine, communications, and travel. Topics such as these generally engage students' interest and are key sources of motivation to develop their ideas about events and phenomena in the world around.

Progression in engaging with content

It is possible to study the same events, habitats and phenomena at different times across the years of schooling as long as the ways in which the content is investigated take account of students' progression over time in the development of relevant ideas. This progression will vary from student to student according to their previous opportunities both in and out of school. A precise description of progress, applying to all students, is thus unrealistic but there are common trends that enable a broad description of what might be expected at various points as students move from preschool through primary and secondary education. These trends include:

- greater recognition that several factors need to be considered if phenomena are to be explained

- greater quantification of observations, using mathematics to refine relationships and deepen understanding
- increasing ability to consider that properties may be explained by features that are not directly observable
- more effective use of physical, mental and mathematical models.

The references here to increasing use of quantification of observations and models of relationships highlight the important role that mathematics takes in developing ideas in science through inquiry. Mathematics helps students to go beyond description in words. Organising data through representation in graphs, charts and tables helps students to notice patterns and make connections that develop their thinking about associations between variables, and to formulate hypotheses about causes that can be tested. Analysing data statistically enables students to make inferences about the probability of relationships and predictions. There is mutual benefit in coordinating science and mathematics education; mathematical tools help understanding in science and, at the same time, using data from science investigations helps in the developing appreciation of the range and application of these tools.

The Changing Role of The Teacher

Sustainability Citizenship, we focused on the roles of school heads, teachers, teacher trainers, pre-service teachers, and curriculum developers. This analysis also includes a comparison of present and future tasks in an educational environment that creates the conditions for the development of SC.

Current Activities of Practitioners

1. School Heads and Teachers:

- They are increasingly aware of their role in promoting sustainability but face challenges due to lack of training, resources, and comprehensive policies. There is a reliance on personal initiative and adaptability.
- **Context**: Operate within systems that lack systemic integration of topics related to SC and often work in isolation or on project-based initiatives.

2. Teacher Trainers:

- Limited emphasis on Sustainability Citizenship during initial teacher training, leading to a shortage of expertise in sustainable development education.
- **Context:** Existing professional development systems are not adequately equipped or focused on Sustainability Citizenship.

3. Pre-service Teachers:

- Engage with sustainability topics more in theory than practice due to the curricular gaps and lack of experiential learning opportunities.
- **Context**: Learning in settings where Education for Sustainable Development is not fully integrated or prioritised, especially at early education levels.

4. Curriculum Developers:

- Struggling to integrate biodiversity and sustainability effectively across the curriculum due to unclear definitions of competences and learning outcomes.
- **Context**: Work within curricula that do not make comprehensive links between key skills, thematic areas, and scientific understanding.

Projection of Future Activities

1. School Heads and Teachers:

- Emphasis will be placed on school self-evaluation as a tool for sustainable development, avoiding mere compliance and focusing on visionary, localized, and evidence-based approaches. Schools will focus on increasing student engagement through self-assessment, peer-review, and decision-making processes. Expected to adopt whole-institution approaches, integrate sustainability into the school's vision, and engage students actively in sustainability projects. Strong collaborations involving schools, local communities, and sustainability stakeholders will be crucial. Cross-sectoral activities and communities of practice will be fostered.
- **Context**: An educational ecosystem supportive of whole-school approaches, with clear policies and action plans for SC.

2. Teacher Trainers:

- Expected to provide more comprehensive training and development opportunities focusing on sustainability, including cross-curricular teaching and leadership skills. Likely to focus more on Sustainability Citizenship in their programs, developing explicit competence frameworks for sustainability.
- **Context**: Will work within reformed professional development systems emphasizing ESD and leadership.

3. Pre-service Teachers:

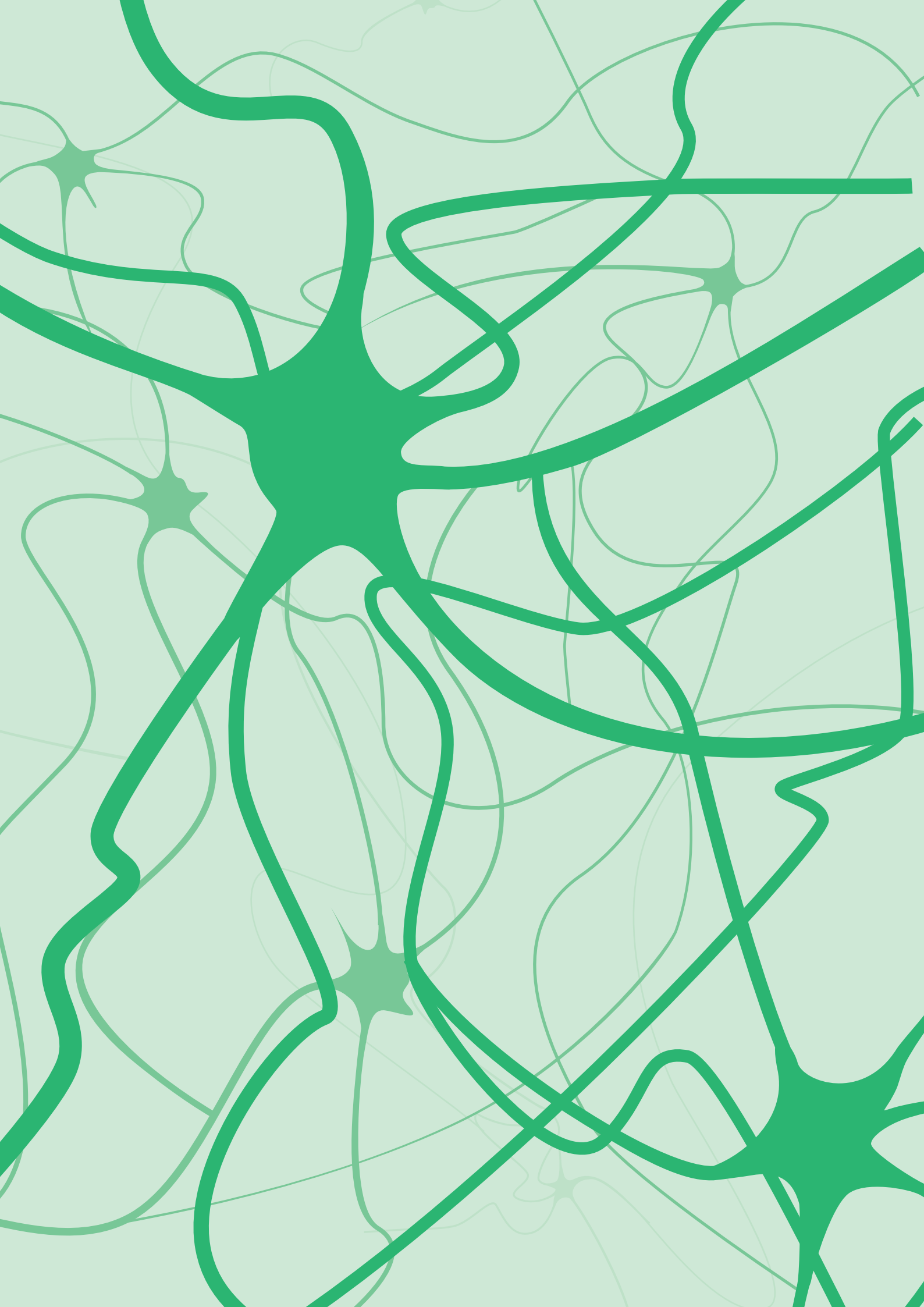
- Projected to have more hands-on interaction and experience with sustainability topics, fostering deeper engagement in nature conservation and will have greater involvement in decision-making processes regarding sustainability issues in schools, enhancing their engagement and critical thinking skills.
- **Context**: A more inclusive and participatory educational setting where student voices significantly influence sustainability initiatives and school policies. Students will learn in settings where SC is a core element of the curriculum, with a focus on experiential learning.

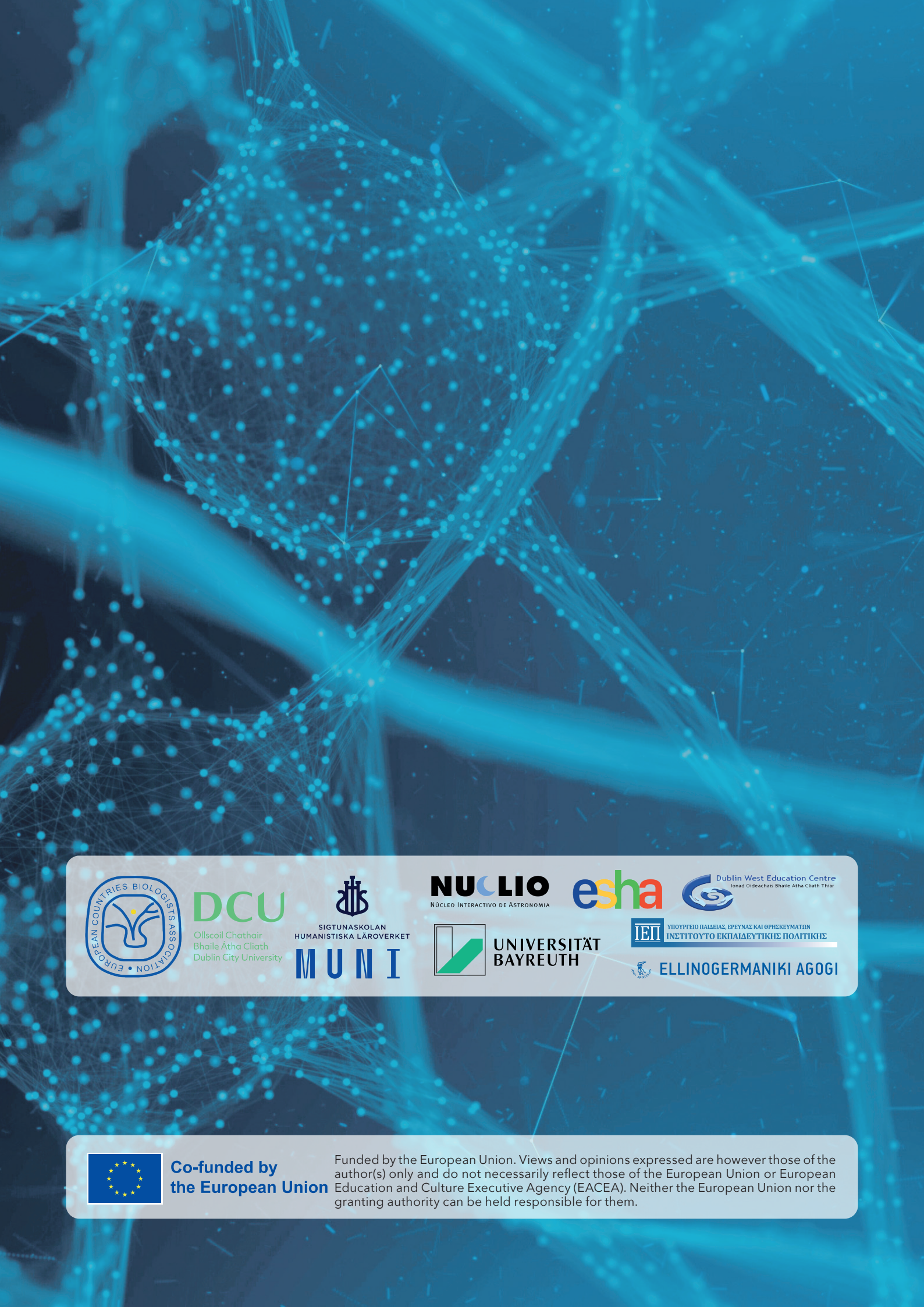
4. Curriculum Developers:

- Expected to support school autonomy and provide resources for sustainability education. This approach allows for addressing local priorities within broader policy frameworks. They will integrate sustainability competences more explicitly and holistically into the curriculum, making links to transversal skills and scientific understanding.
- **Context**: Expected to work within frameworks that prioritise SC and provide clear guidelines for implementing it across disciplines.

An educational ecosystem focusing on the development of Sustainability Citizenship

- **From Policy to Practice**: Future tasks will involve translating policies into actionable plans at the school level, with a more coherent and integrated approach.
- **From Isolated to Integrated Approaches**: The shift from isolated, project-based initiatives to systemic, whole-institution approaches with stronger collaborations and partnerships that include schools, local communities, and various stakeholders.
- **From Theory to Practice**: Moving from a theoretical understanding of sustainability to practical, hands-on experiences.
- **From Inadequate Training to Comprehensive Development**: Expanding professional development opportunities for educators to include sustainability competences and leadership skills.
- **From Fragmented to Holistic Curriculum Design**: Evolving from fragmented curricular elements to a holistic integration of sustainability.
- **Enhanced Student Participation**: Future initiatives will see a significant increase in student involvement in sustainability activities, fostering a sense of ownership and responsibility.
- **Evaluation and Monitoring Shifts**: Future tasks will emphasize self-evaluation and formative external evaluation as tools for continuous improvement in sustainability education.
- **Empowering Teachers and Leaders**: Professional development and leadership training will become more prevalent, focusing on sustainable practices and holistic education approaches.





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