

A PEDAGOGICAL FRAMEWORK FOR IMPLEMENTING SUSTAINABLE DEVELOPMENT GOAL No 6 IN EDUCATION - A WATER RESPONSIBILITY LEARNING MODEL

Amalia Venera Todoruț

PhD, Professor, „Constantin Brâncuși” University, Târgu-Jiu, Romania,
amalia_venera@yahoo.com

Abstract

*The Sustainable Development Goals (SDGs) adopted within the United Nations 2030 Agenda assign a central role to education in advancing sustainability. Among them, SDG 6 (Clean Water and Sanitation) provides a particularly valuable framework for educational implementation, because it connects environmental protection, human well-being, ecosystem protection and services and, in a more global perspective, the responsible use of resources. This paper examines how SDG 6 can be translated into educational practice through a pedagogical approach focused on freshwater sustainability. The paper argues that rivers, lakes, wetlands and water-related ecosystems offer a powerful context for Education for Sustainable Development (ESD). The paper proposes that effective implementation of SDG 6 in education can move learners from **water knowledge** to **water literacy** and ultimately to **sustainable water responsibility**, by proposing two conceptual frameworks. First, a three-part model of education **about, through and for** water sustainability and a second, cyclical **Water Responsibility Learning Framework** that progresses through experience, understanding, connection, systems thinking, evaluation, action and reflection. The paper also considers the pedagogical value of familiar freshwater settings such as the Danube basin and associated wetlands, as meaningful learning environments. It concludes that SDG 6 can serve not only as a thematic content area, but also as a broader educational platform for cultivating systems thinking, environmental responsibility and sustainable action.*

Keywords: education, sustainability, well-being, responsibility

1. Introduction

Water is a fundamental prerequisite for life and a central component of sustainable development. It supports human health, food production, biodiversity, energy systems, economic activity and the functioning of both natural and human communities. At the same time, freshwater resources are under increasing pressure from pollution, excessive abstraction, land-use change, ecosystem degradation, urbanisation and climate-related changes in rainfall, drought and flooding. Modern pressures and subsequent impacts, demonstrate that water is not a limitless physical resource. It is simultaneously an ecological, social, economic and ethical issue, requiring decisions about access, use, protection and responsible management.

The importance of water is reflected in the United Nations *2030 Agenda for Sustainable Development*, adopted in 2015. Sustainable Development Goal 6 (SDG 6), *Clean Water and Sanitation*, calls for the availability and sustainable management of water and sanitation for all. Its scope extends considerably beyond drinking-water provision and sanitation. It includes the improvement of water quality, reduction of pollution, more efficient water use, integrated water-

resources management and the protection and restoration of water-related ecosystems and eco services. Target 6.6 is particularly relevant to environmental education because it explicitly addresses ecosystems associated with water, including wetlands, rivers, aquifers and lakes. *United Nations (2015), Transforming our world: the 2030 Agenda for Sustainable Development. New York: United Nations. [Goal 6 | Department of Economic and Social Affairs](#)*

Education has an important role in translating such global objectives into knowledge, values, competences and behaviour. UNESCO identifies Education for Sustainable Development (ESD) as an important enabling mechanism for the implementation of all Sustainable Development Goals. ESD is intended to develop cognitive, socio-emotional and behavioural outcomes that allow learners to understand sustainability problems, evaluate alternatives and participate in individual and collective responses. UNESCO's *ESD for 2030* framework similarly emphasizes the transformative role of education and identifies policy, learning environments, educator capacity, youth engagement and local-level action as priority areas. *UNESCO (2017), Education for Sustainable Development Goals: Learning objectives. Paris: UNESCO.*

Water offers an especially suitable context in which these principles can be applied. Unlike some sustainability issues that may appear distant or abstract to learners, water is part of everyday experience. Children encounter rainfall, drinking water, streams, rivers, ponds, lakes and wetlands; they observe drought, flooding, waste, agricultural activity and water consumption in their communities. These familiar experiences can provide an entry point into much larger questions concerning ecosystem functioning, resource management, environmental justice, climate change and human responsibility. Water can therefore connect the local and the global in a form that is understandable even to younger learners.

From our experience, conventional water education often remains concentrated on factual or technical knowledge. Students learn the hydrological cycle, identify the stages of evaporation and precipitation, or describe different aquatic habitats, without however, necessarily understanding the wider social and ecological systems in which water operates. Knowledge of the water cycle is of course very important, but on its own, it does not enable learners to understand why river pollution occurs, how upstream activities affect downstream communities, why wetlands matter, how agricultural production influences water quality, or why competing users may have different interests in the same water resource. Sustainability education consequently requires a shift from simply knowing facts about water towards understanding water as part of an interconnected socio-ecological system.

This shift corresponds with the broader development of sustainability education from the transmission of environmental knowledge toward the cultivation of competences. Wiek, Withycombe and Redman (2011), for example, identify systems thinking, anticipatory competence, normative competence, strategic competence and interpersonal competence as important dimensions of sustainability learning. These competencies require learners not merely to describe environmental problems but to recognize relationships, consider future consequences, evaluate values and alternatives, and participate in developing possible responses. Wiek, A., Withycombe, L. & Redman, C.L. Key (2011). Competencies in sustainability: a reference framework for academic program development. *Sustain Sci* 6, 203–218 <https://doi.org/10.1007/s11625-011-0132-6>

Within the field of water education, the related concept of **water literacy** has gained increasing attention. McCarroll and Hamann (2020) describe water literacy as involving not only water-related knowledge but also attitudes and behaviours. Their review highlights the need for approaches that are interdisciplinary, locally meaningful and capable of connecting

understanding with responsible action. More recent reviews of water education likewise indicate growing interest in experiential, community-based and interdisciplinary approaches rather than water being treated only as isolated scientific content. McCarroll, M. and H. Hamann, (2020) What We Know about Water: A Water Literacy Review. *Water*, 12(10), 2803; <https://doi.org/10.3390/w12102803>

This paper builds upon these developments by arguing that implementation of SDG 6 in education should be conceived as a progression from **water knowledge**, through **water literacy**, toward **water responsibility**. Water knowledge refers to understanding physical, ecological and social dimensions of freshwater systems. Water literacy adds the ability to interpret water-related problems, recognise interdependencies and evaluate choices. Water responsibility extends this progression further by incorporating responsibility, participation and willingness to contribute to the sustainable use and protection of freshwater environments.

The aim of this conceptual paper is therefore to examine the educational significance of SDG 6 and to propose a pedagogical framework through which freshwater sustainability can be incorporated into school education. Particular attention is given to rivers, lakes and wetlands because these environments allow students to investigate the relationship between ecological processes and human activities at multiple spatial scales. The paper subsequently develops two complementary conceptual models: education **about, through and for water sustainability**, and a cyclical **Water responsibility Learning Framework**. These models provide a generic structure that can later be adapted to national and local contexts, including river-basin environments such as the Danube and its associated wetlands.

2. SDG 6 and the Educational Significance of Freshwater Sustainability

SDG 6 is frequently associated in public discussion with safe drinking water and sanitation, yet its environmental dimension is considerably broader. Targets within the goal address water quality, wastewater, efficiency of water use, integrated management of water resources and the conservation of water-related ecosystems. This broader interpretation is important educationally because it makes it possible to approach water not as a single issue but as a system connecting ecological processes, human activities and social choices.

Target 6.3, for example, emphasizes the reduction of pollution and improvement of water quality, while Target 6.5 promotes integrated water-resources management. Target 6.6 explicitly addresses the protection and restoration of water-related ecosystems. Together, these targets create substantial opportunities for interdisciplinary education. Water quality involves chemistry, biology, public health, agriculture and waste management. River-basin management introduces geography, governance and competing economic uses. Wetland protection connects ecology, biodiversity, flood regulation and land-use planning. SDG 6 can therefore become an educational framework through which learners encounter the interdependence of natural and human systems rather than studying environmental issues in isolation.

UNESCO's learning objectives for SDG 6 reinforce this broader interpretation. At the cognitive level, learners are expected to understand the significance of water quantity and quality, the causes and consequences of pollution and scarcity, and the fact that water forms part of complex global interrelationships. UNESCO also includes understanding of integrated water-resources management and of flood and drought risks. Socio-emotional objectives include responsibility for personal water use, communication about water problems and participation in improving local water management. Behavioural objectives extend further, towards contributing

to local water-resource management, reducing individual water footprints and participating in activities that improve water quality and safety.

This is educationally important because it demonstrates that SDG 6 cannot be satisfactorily addressed through factual instruction alone. The goal itself implies a progression from **understanding** to **responsibility** and ultimately to **competent participation**. In this respect, freshwater sustainability is consistent with the general philosophy of ESD, which combines cognitive, socio-emotional and behavioural learning domains.

Rivers provide a particularly clear example. A river should not be understood only as flowing water within a channel. It forms part of a catchment in which rainfall, groundwater, soil, vegetation, agriculture, settlements, industry and infrastructure interact. Pollution entering a tributary can be transported downstream; removal of riparian vegetation can affect erosion and water temperature; agricultural nutrients can influence aquatic ecosystems; dams can alter flow and sediment movement; and excessive abstraction can affect both ecological conditions and downstream users. The river therefore provides a practical illustration of systems thinking.

Lakes and wetlands offer similarly rich educational contexts. Wetlands may regulate water flow, retain sediments and nutrients, provide habitats and contribute to flood mitigation. Their degradation can consequently produce effects extending beyond the immediate site. Teaching about such ecosystems allows students to move from the idea of nature as a collection of separate organisms toward a more functional understanding of ecosystem processes and services. It also introduces an important sustainability principle: environmental protection is not separate from human well-being but often supports it. Freshwater sustainability also makes the interconnections among the SDGs particularly visible. Water quality is linked to health; agricultural water use to food production; wastewater and urban drainage to sustainable cities; floods and droughts to climate change and adaptation; freshwater ecosystems to biodiversity; and river pollution ultimately to downstream coastal and marine environments. SDG 6 therefore provides a useful way of demonstrating that the Sustainable Development Goals should not be interpreted as independent objectives. Rather, they form an interconnected framework in which progress or failure in one area can influence several others.

For education, this interconnectedness is valuable because it encourages learners to pursue further and deeper understanding of the relationship between humans and water. Such an approach transforms environmental content into sustainability learning. The local character of freshwater systems also creates opportunities for place-based education. Even where schools are distant from major rivers or wetlands, they remain connected to water through drinking-water supply, drainage, wastewater, local rainfall, food production and household consumption. As a result, SDG 6 can be interpreted through environments that learners know personally while at the same time linking those environments to larger regional and global systems. This local-to-global progression is particularly valuable because sustainability problems are often difficult to understand when presented only through global statistics or distant case studies.

The educational significance of SDG 6 therefore rests not only in the importance of water itself but also in its capacity to make sustainability relationships visible. Water moves across boundaries, links landscapes and communities, supports multiple and sometimes competing uses, and responds to both natural processes and human decisions. These characteristics make freshwater an unusually powerful context for developing the systems perspective required by ESD.

3. From Water Knowledge to Water Literacy

The distinction between **water knowledge** and **water literacy** is central to the pedagogical argument developed in this paper. Knowledge remains indispensable: learners require a basic understanding of hydrological processes, freshwater ecosystems, water quality, human uses of water and major environmental pressures. However, sustainability problems cannot be addressed by factual knowledge alone. Water literacy extends beyond factual knowledge of hydrological processes and incorporates understanding, attitudes, values, and the capacity to respond appropriately to water-related challenges. A learner may accurately describe the water cycle while remaining unable to explain how agricultural practices affect a river, why upstream and downstream communities may experience different consequences, or how individual consumption choices are connected to wider patterns of resource use. Water literacy extends beyond knowing *about* water. McCarroll and Hamann's review conceptualizes water literacy in holistic terms encompassing knowledge, attitudes and behaviour, while also emphasizing the importance of place-based, interdisciplinary and reflective approaches. In educational terms, a water-literate learner should be able to understand how water systems function, identify important human–water relationships, interpret evidence concerning water-related problems, recognise uncertainty and competing interests, and use this understanding when considering decisions and actions. Recent educational research confirms that water literacy is increasingly approached through both formal and non-formal education, with growing emphasis on experiential, interdisciplinary and community-based learning approaches (Imaduddin & Eilks, 2024). Imaduddin, M. and Eilks, I. (2024), A scoping review and bibliometric analysis of educational research on water literacy and water education, *Sustainable Chemistry and Pharmacy* 42, <https://doi.org/10.1016/j.scp.2024.101833>

4. Education About, Through and For Water Sustainability

The educational significance of SDG 6 extends beyond the inclusion of water as a thematic area within school curricula. If water is treated only as a scientific topic, learning risks remaining descriptive and fragmented, confined to factual content such as the water cycle, the properties of water, or the classification of aquatic ecosystems. Although such knowledge is necessary, it does not by itself equip learners to understand the broader sustainability implications of water use, water degradation, and freshwater ecosystem protection. For this reason, the implementation of SDG 6 in education requires a broader pedagogical conception. In this paper, this conception is expressed through a three-part framework of education **about**, **through**, and **for** water sustainability.

This distinction is useful because it clarifies that water can function simultaneously as **content**, **context**, and **purpose** within sustainability education. In other words, learners must first develop foundational understanding **about** water; they must then learn **through** water by using water-related themes as a means of developing broader competencies; and finally, they should be supported in learning **for** water sustainability, so that knowledge and competencies may contribute to responsible action and environmental responsibility. Together, these three dimensions offer a coherent pedagogical structure for translating SDG 6 into educational practice.

4.1 Education about water sustainability

Education **about** water sustainability refers to the acquisition of knowledge and understanding concerning freshwater systems, their ecological characteristics, and the pressures that affect them. At this level, the learner is introduced to water as an object of study. This includes knowledge of rivers, lakes, wetlands, aquifers and watersheds; the hydrological cycle; water quality; biodiversity in freshwater environments; and the major human pressures associated with pollution, overuse, habitat degradation and climate change. Such knowledge is indispensable, because sustainability learning cannot develop in the absence of conceptual understanding. Learners need to understand, for example, how pollutants enter freshwater systems, how wetland loss affects biodiversity and flood regulation, or how changing rainfall patterns may influence water availability. They also need to recognise that freshwater systems are dynamic and interconnected rather than static and isolated features of the landscape. At this level, education remains largely cognitive, but it should not be reduced to rote memorisation. Even the teaching of factual content benefits from contextualisation. Water-related concepts are more meaningful when they are linked to concrete places, examples and visible environmental issues. Thus, education **about** water sustainability should encourage learners to connect abstract scientific knowledge with the freshwater realities of their own region or community.

4.2 Education through water sustainability

Education **through** water sustainability moves one step further. Here, water is not only the topic being studied, but also the medium through which broader educational goals and competencies are developed. Water provides an especially effective interdisciplinary context because it lies at the intersection of science, geography, history, economics, citizenship, health and ethics.

Through water-related themes, learners can develop scientific inquiry skills by observing, comparing and interpreting environmental phenomena. They can strengthen numeracy by reading graphs, interpreting quantities and trends, or comparing patterns of consumption and water quality. They can develop geographical understanding by examining river basins, upstream–downstream relationships and land-use patterns. Water also offers rich opportunities for language and communication learning through discussion, report writing, presentations and argumentation around environmental issues.

Most importantly, education **through** water sustainability supports the development of key sustainability competences. Among these, systems thinking is particularly important. Water naturally invites learners to consider relationships rather than isolated facts: rainfall affects river flow; agricultural runoff affects water quality; water quality affects biodiversity and human health; urban growth alters water demand and drainage patterns; and climate change influences both droughts and floods. In this way, water becomes a pedagogical lens through which learners can recognise interdependence, causality and feedback. Water-related issues also encourage ethical reflection and civic understanding. Questions of water allocation, pollution control, conservation, and access to safe water raise issues of responsibility, fairness and collective decision-making. Learners may therefore begin to appreciate that environmental problems are not only scientific, but also social and political. In this sense, water becomes a particularly effective context for the integration of Education for Sustainable Development across subject boundaries.

4.3 Education for water sustainability

Education **for** water sustainability introduces the normative and action-oriented dimension of learning. Its purpose is not only to increase awareness, but also to contribute to the formation of environmentally responsible attitudes, dispositions and capabilities. If education **about** water centres on knowledge, and education **through** water emphasises the development of broader competencies, education **for** water sustainability is concerned with preparing learners to contribute, at an age-appropriate level, to the sustainable use and protection of freshwater systems. This dimension includes the cultivation of values such as responsibility, care, respect for ecosystems and sensitivity to the consequences of human actions. It also includes the development of action competence: the capacity to evaluate options, participate in discussions, make informed choices and undertake responsible forms of individual or collective action. Such action need not be understood in a narrow or overly ambitious sense. For younger learners, it may involve responsible water use, observation of local water issues, or participation in school-based environmental initiatives. For older learners, it may extend to community projects, local environmental investigations, awareness campaigns, or critical engagement with policy questions.

What is important is that learners come to understand that water sustainability is not solely the domain of experts, engineers or public authorities. While institutions have central responsibilities in water governance, citizens also play a role through everyday practices, public awareness, participation and support for sustainable policies. Education **for** water sustainability therefore aims to strengthen the relationship between understanding and responsibility.

4.4 The value of the three-part framework

The distinction between education **about**, **through** and **for** water sustainability is useful because it helps avoid two common limitations. The first is an overly narrow scientific treatment of water, where students learn facts but are not guided to understand their broader significance. The second is an overly general treatment of sustainability, where abstract values are discussed without being grounded in a meaningful environmental context. The three-part framework brings these elements together by ensuring that learning begins with sound knowledge, expands toward interdisciplinary competence, and culminates in responsibility and action.

This framework also aligns well with the broader educational aims of ESD. It recognises that sustainability learning should include cognitive, socio-emotional and behavioural dimensions. It also allows water education to be adapted across different age groups and educational levels. Younger learners may place greater emphasis on direct observation and the **about** dimension, while older learners may increasingly engage with the **through** and **for** dimensions as their capacity for abstraction, systems thinking and critical evaluation develops. Figure 1 provides the first conceptual model for implementing SDG 6 in education. It establishes water not merely as a subject of study, but as a pedagogical platform through which sustainability, understanding, competence and responsibility, can be achieved.

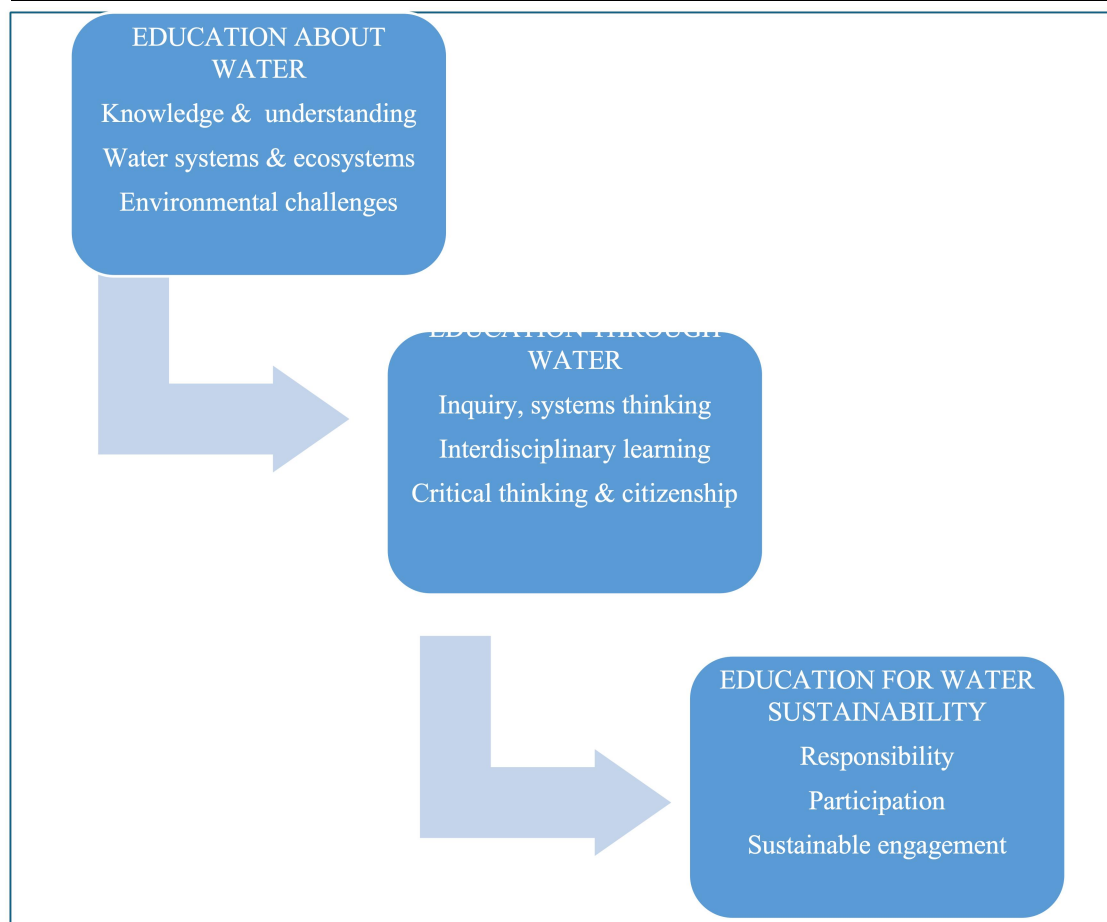


Figure 1. A three-part pedagogical model showing how SDG 6 can be implemented in education through learning **about**, **through**, and **for** water sustainability.

Source: processing United Nations. *Sustainable Development Goal 6*

5. A Water Responsibility Learning Framework

While the previous section defined the broad pedagogical orientation of education **about**, **through** and **for** water sustainability, a more operational framework is needed to show how these dimensions may be translated into educational practice. For this purpose, the present paper proposes a **Water Responsibility Learning Framework**. This framework is designed as a cyclical model rather than a strictly linear sequence, since meaningful sustainability learning develops through repeated engagement, reflection and renewed inquiry. The model is intended to support the progression from **water knowledge** to **water literacy** and ultimately to **water responsibility**. The framework (see Figure 2) consists of seven interrelated stages: **Experience**, **Understand**, **Connect**, **Think Systemically**, **Evaluate**, **Act**, and **Reflect**. Although presented sequentially for clarity, these stages should not be interpreted rigidly. Learners may move back and forth between them, and classroom practice may revisit earlier phases as new questions or insights emerge. The cyclical structure reflects the idea that learning about sustainability is continuous, cumulative and responsive to context.

5.1 Experience

The framework begins with **experience**. Sustainability learning is strengthened when it is rooted in direct or meaningful encounters with the environment. In the case of water education, these encounters may include observation of a local river, stream, lake, pond or wetland; awareness of rainfall, drought or flooding; attention to school or household water use; or examination of maps, images and stories related to freshwater systems. Even where direct field access is limited, learners can be introduced to water issues through case studies, visual materials, local examples or community knowledge.

The purpose of this stage is to create relevance. Water becomes educationally powerful when learners perceive it not as an abstract resource but as part of lived reality. Experience also supports curiosity, observation and emotional connection, which are important foundations for later understanding and responsibility.

5.2 Understand

The second stage is **understand**. Here, learners build the conceptual and scientific knowledge needed to interpret what they observe. This includes understanding freshwater ecosystems, watershed processes, water quality, biodiversity, water use, pollution pathways and the influence of climate and land use on water systems. At this stage, structured teaching, guided inquiry and age-appropriate explanation are essential. The aim is to ensure that learners do not remain at the level of impression or general concern, but acquire the knowledge necessary to make sense of water-related issues. Understanding transforms experience into informed awareness. It is also the point at which learners begin to connect local phenomena to wider ecological and hydrological principles.

5.3 Connect

The third stage, **connect**, focuses on relationships between water and human activity. Learners are encouraged to ask how people depend on water, how they affect it, and how different uses and interests are connected. This may include domestic consumption, agriculture, industry, recreation, transport, cultural identity, tourism or ecosystem services. This stage is important because it counters the false separation of society and nature. Water is not only a natural system; it is also embedded in everyday life, economic activity and social organisation. By exploring these connections, learners begin to understand freshwater as a socio-ecological system. They also become more capable of recognising that environmental issues involve human choices, patterns of behaviour and institutional decisions.

5.4 Think systemically

The fourth stage, **think systemically**, represents a more advanced level of interpretation. Learners are guided to explore causal chains, interdependence and feedback. For example, they may examine how land use affects runoff, how runoff affects water quality, how water quality affects ecosystems and health, or how upstream decisions create downstream consequences. They may also explore how drought or flooding results from interactions among climate, land

management, infrastructure and water demand. Systems thinking is particularly important in sustainability education because many environmental problems appear simple on the surface but are, in fact, produced by interacting factors. Water offers an ideal opportunity for the development of this competence because the movement of water across landscapes and communities makes interconnections especially visible. At this stage, learners move beyond isolated observations toward a more integrated understanding of complexity.

5.5 Evaluate

The fifth stage is **evaluate**. Once learners understand relationships and systems, they are better positioned to consider options, trade-offs and responsibilities. Evaluation involves asking questions such as: What are the main causes of a particular water problem? Which actors are involved? What interests may conflict? Which responses appear more sustainable? Who benefits, and who bears the costs? What should be prioritised? This stage introduces critical thinking and ethical reflection. It also helps students realise that environmental decisions are rarely neutral or purely technical. Water problems often involve questions of justice, resource allocation, governance and long-term sustainability. Encouraging learners to evaluate alternatives strengthens their judgement and helps prepare them for responsible participation.

5.6 Act

The sixth stage is **act**. Learning for sustainability should not end with understanding alone. At an age-appropriate level, learners should be encouraged to translate knowledge and evaluation into forms of responsible engagement. These may include personal actions such as reducing wasteful water use, school-based practices such as awareness activities or water-saving initiatives, participation in local environmental projects, or communication of findings and concerns to wider audiences.

The purpose of this stage is not to overburden learners with unrealistic expectations, but to reinforce the idea that understanding can and should inform practice. Action, even in modest forms, helps consolidate learning, strengthen agency and demonstrate that environmental responsibility is not purely theoretical. In educational terms, this is the stage where water literacy begins to mature into responsible water action.

5.7 Reflect

The final stage is **reflect**, which returns the cycle to renewed experience and understanding. Reflection allows learners to consider what they have learned, how their views have changed, what difficulties they encountered, and what further questions have emerged. Reflection may also involve considering the effectiveness of particular actions, the limits of individual effort, and the role of institutions and collective processes in sustainable water management.

This stage is essential because sustainability learning is not a one-time event. Reflection deepens understanding and often generates new curiosity. A school activity concerning local water quality, for example, may lead learners to ask new questions about land use, biodiversity, rainfall

patterns or community behaviour. In this way, the cycle begins again, and water education becomes an ongoing process of inquiry, understanding and responsible engagement.

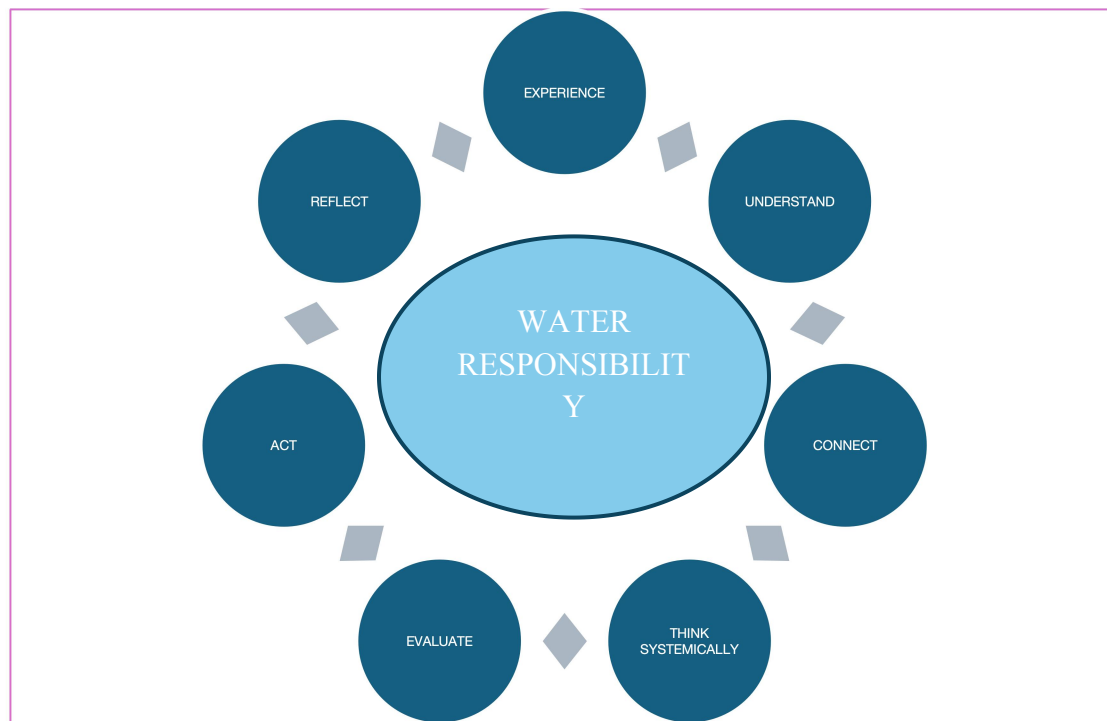


Figure 2. Water Responsibility Learning Framework.

Source: processing UNESCO (2017)

5.8 Educational value of the framework

The Water Responsibility Learning Framework depicted in Figure 2, offers several advantages. First, it integrates cognitive, socio-emotional and behavioural dimensions of learning, thereby aligning well with ESD. Second, it provides a structure flexible enough to be adapted across age groups, subjects and contexts. Third, it keeps the learner's experience and local environment at the centre, while also opening pathways toward broader systems understanding. Finally, it avoids reducing environmental education either to factual instruction or to superficial activism; instead, it proposes a progression in which experience, understanding, judgement and action are mutually reinforcing. The framework is also compatible with a wide variety of pedagogical approaches. Inquiry-based learning, fieldwork, project-based learning, place-based education, case studies, community partnerships and even selected forms of citizen participation can all be incorporated within it. In this sense, the framework does not prescribe a single method; rather, it provides a pedagogical logic for organising sustainability learning around freshwater issues.

6. Freshwater Contexts as Learning Environments: Rivers, Lakes, Wetlands and the Danube

Freshwater environments provide particularly suitable settings for translating the conceptual principles of SDG 6 into educational practice. Rivers, lakes and wetlands are not simply examples of aquatic ecosystems; they are places where ecological processes, human activities and sustainability challenges become visible and interconnected. Their educational value therefore lies in their capacity to transform abstract concepts such as ecosystem health, pollution, resource use and climate adaptation into issues that learners can observe, investigate and relate to their own communities. Rivers are especially valuable from the perspective of systems thinking. A river connects different landscapes, settlements and economic activities along its course, demonstrating that environmental processes do not respect administrative boundaries. Activities occurring upstream may influence water quality, biodiversity and human communities many kilometres downstream. Agricultural runoff, urban wastewater, industrial emissions, changes in land use and alterations to river morphology can consequently be examined as parts of an interconnected system rather than as isolated environmental problems. This upstream–downstream relationship also provides an accessible educational introduction to concepts of shared responsibility and transboundary environmental governance.

Lakes provide a complementary learning environment because changes in water quality, nutrient inputs, biodiversity and human use can often be observed within a clearly defined geographical setting. Wetlands are particularly important because they illustrate the multiple functions performed by natural ecosystems. They support biodiversity, retain water and nutrients, contribute to flood regulation and create important cultural and economic benefits. Their study therefore provides an opportunity to demonstrate that ecosystem conservation and human well-being should not be regarded as competing objectives. The **Danube River Basin** offers an especially relevant example for applying these educational principles in a European and Romanian context. The Danube is an international river system in which environmental conditions are influenced by activities across many countries. Its management therefore depends upon cooperation at the river-basin scale. The International Commission for the Protection of the Danube River (ICPDR), operating within the framework of the EU Water Framework Directive, addresses issues including nutrient and hazardous-substance pollution, hydromorphological alteration, drought, water scarcity, flooding and climate change. The management approach also explicitly recognizes public participation and the need to coordinate water management across national boundaries.

For educational purposes, the Danube therefore provides more than a geographical case study. It can function as a **living representation of sustainability interdependence**. Learners can trace relationships between land use and river quality, between upstream activities and downstream impacts, or between climate variability and water availability. They can also examine why the management of a shared river requires cooperation between communities, sectors and countries. Such examples bring systems thinking, environmental responsibility and citizenship into the same learning context. The **Danube Delta** further extends this educational potential. Located at the end of the river system and shared by Romania and Ukraine, the Delta contains an extensive network of channels, lakes, wetlands and islands and supports exceptionally rich biodiversity. UNESCO describes it as Europe's largest wetland and reed-bed system and emphasizes its importance for birds, fish and other wildlife. The Delta therefore makes the upstream–downstream relationship particularly visible: pressures generated

throughout a river basin can ultimately influence downstream wetlands and, eventually, the coastal and marine environment. This river-to-delta perspective can help learners understand that freshwater sustainability cannot be separated from wider environmental systems. A useful educational sequence might follow a pollutant, nutrient or piece of plastic from a local community into a stream, from the stream into a larger river, through the Danube basin and eventually toward the Delta and Black Sea. Similarly, students can examine how drought, floods or changes in land management produce consequences across ecological and social systems.

Such learning does not necessarily require sophisticated field equipment or extensive excursions. Maps, photographs, historical records, simple water observations, local case studies, classroom experiments and digital geographical resources can all be used. Direct field experiences may strengthen learning where they are feasible, but the essential pedagogical objective is to help students establish relationships between **place, process, human activity and environmental consequence**. In this way, rivers, lakes and wetlands become not merely objects of environmental education, but learning environments through which the broader aims of SDG 6 and Education for Sustainable Development can be explored.

7. Implications for Curriculum and Teacher Education

Implementing water sustainability in education does not require the creation of a separate school subject. Its interdisciplinary character makes it particularly suitable for integration within existing curricula. Scientific concepts such as water quality, ecosystems and hydrology can be linked with geography, mathematics, language, citizenship, economics and digital competence. The objective is therefore not simply to add additional environmental content, but to use freshwater issues as contexts through which existing curricular objectives and sustainability competences can be developed.

This approach also has implications for assessment. If water education is intended to progress from **water knowledge** toward **water literacy** and **water responsibility**, assessment should extend beyond factual recall. Learners should also have opportunities to interpret information, identify relationships, compare alternatives, explain environmental consequences and justify possible responses. The ability to understand a water-related problem as part of a wider system may therefore be as important educationally as knowing the terminology associated with that system. Teacher preparation is central to successful implementation. UNESCO's ESD for 2030 framework identifies educator capacity as one of its priority action areas, alongside transforming learning environments and accelerating action at the local level. Teachers require not only appropriate environmental knowledge but also confidence in interdisciplinary teaching, systems thinking, experiential approaches and discussion of sustainability problems that may not have simple solutions.

Professional development should consequently help educators connect curricular content with locally relevant water issues and provide flexible teaching approaches that can be adapted to different school environments. Partnerships with universities, environmental agencies, municipalities, protected-area authorities and community organisations may further strengthen this process. The ICPDR's emphasis on public information, educational outreach and stakeholder participation within Danube water governance illustrates the wider institutional context within which such school–community connections can develop. The goal should ultimately be to make water sustainability part of normal educational practice rather than an occasional environmental activity. When curricular knowledge, local experience and sustainability competences are

combined, SDG 6 can provide a practical bridge between formal education and the environmental realities affecting learners' communities.

8. Conclusion

SDG 6 provides a particularly effective framework through which Education for Sustainable Development can be translated into meaningful educational practice. Although water is traditionally present in school curricula, learning about the hydrological cycle or aquatic ecosystems alone is insufficient to prepare learners for the complexity of contemporary freshwater challenges. Effective water education should connect scientific understanding with human activity, systems thinking, ethical reflection and responsible action. This paper has therefore proposed a progression from **Water Knowledge** → **Water Literacy** → **Water Responsibility**. Two complementary pedagogical frameworks support this progression. The first distinguishes education **about**, **through** and **for** water sustainability, while the second describes a cyclical learning process incorporating experience, understanding, connection, systems thinking, evaluation, action and reflection.

Rivers, lakes and wetlands provide particularly meaningful environments for applying these principles. The Danube and Danube Delta demonstrate how freshwater systems connect communities, ecosystems and human activities across local, national and international scales. Their educational value lies not simply in what students can learn *about* them, but in the wider relationships they can help students understand. The implementation of SDG 6 in education should therefore be viewed not as the addition of another sustainability topic to an already crowded curriculum, but as an opportunity to develop environmentally literate and responsible learners capable of understanding interconnected systems and making informed decisions concerning the environments on which societies depend.

BIBLIOGRAPHY

1. Brundiers, K., Barth, M., Cebrián, G., et al. (2021). Key competencies in sustainability in higher education—Toward an agreed-upon reference framework. *Sustainability Science*, 16, 13–29.
2. Falkenmark, M., & Rockström, J. (2004). *Balancing water for humans and nature: The new approach in ecohydrology*. Earthscan.
3. Imaduddin, M., & Eilks, I. (2024). A scoping review and bibliometric analysis of educational research on water literacy and water education. *Sustainable Chemistry and Pharmacy*, 42, 101833. <https://doi.org/10.1016/j.scp.2024.101833>
4. International Commission for the Protection of the Danube River (ICPDR). (2021). *Danube River Basin Management Plan: Update 2021*. ICPDR.
5. Jensen, B. B., & Schnack, K. (1997). The action competence approach in environmental education. *Environmental Education Research*, 3(2), 163–178. <https://doi.org/10.1080/1350462970030205>
6. McCarroll, M., & Hamann, H. (2020). What we know about water: A water literacy review. *Water*, 12(10), 2803. <https://doi.org/10.3390/w12102803>
7. Mogensen, F., & Schnack, K. (2010). The action competence approach and the ‘new’ discourses of education for sustainable development, competence and quality criteria. *Environmental Education Research*, 16(1), 59–74. <https://doi.org/10.1080/13504620903504032>
8. Orr, D. W. (1992). *Ecological literacy: Education and the transition to a postmodern world*. State University of New York Press.
9. Palmer, J. A. (1998). *Environmental education in the 21st century: Theory, practice, progress and promise*. Routledge.
10. Postel, S., & Richter, B. (2003). *Rivers for life: Managing water for people and nature*. Island Press.
11. Ramsar Convention on Wetlands. (2018). *Global wetland outlook: State of the world's wetlands and their services to people*. Ramsar Convention Secretariat.
12. Rieckmann, M. (2012). Future-oriented higher education: Which key competencies should be fostered through university teaching and learning? *Futures*, 44(2), 127–135.
13. Rickinson, M., Dillon, J., Teamey, K., et al. (2004). *A review of research on outdoor learning*. National Foundation for Educational Research.
14. Sauvé, L. (2005). Currents in environmental education: Mapping a complex and evolving pedagogical field. *Canadian Journal of Environmental Education*, 10, 11–37.
15. Sipos, Y., Battisti, B., & Grimm, K. (2008). Achieving transformative sustainability learning: Engaging head, hands and heart. *International Journal of Sustainability in Higher Education*, 9(1), 68–86.
16. Sobel, D. (2004). *Place-based education: Connecting classrooms and communities*. Orion Society.
17. Sterling, S. (2001). *Sustainable education: Re-visioning learning and change*. Green Books.
18. Tilbury, D. (1995). Environmental education for sustainability: Defining the new focus of environmental education in the 1990s. *Environmental Education Research*, 1(2), 195–212.
19. UNESCO. (2017). *Education for Sustainable Development Goals: Learning objectives*. UNESCO.
20. UNESCO. (2020). *Education for sustainable development: A roadmap*. UNESCO.
21. United Nations. (2015). *Transforming our world: The 2030 Agenda for Sustainable Development*. United Nations.
22. United Nations. *Sustainable Development Goal 6: Ensure availability and sustainable management of water and sanitation for all*.
23. Wiek, A., Withycombe, L., & Redman, C. L. (2011). Key competencies in sustainability: A reference framework for academic program development. *Sustainability Science*, 6, 203–218. <https://doi.org/10.1007/s11625-011-0132-6>
24. UNECE. (2012). *Learning for the future: Competences in Education for Sustainable Development*. United Nations Economic Commission for Europe.
25. UNESCO. *Danube Delta Biosphere Reserve* — useful specifically for the short Romanian/Danube application rather than as a major theoretical source.