

The education approach to sustainable water management

VGENOPOULOU* E., EVRENOGLOU L. and DAMIKOUKA I.

Department of Public Health Policy, School of Public Health, University of West Attica, 196 Alexandras Avenue, 115 21, Athens, Greece

*corresponding author:
e-mail: evgenopoulou@uniwa.gr

Abstract Water has a leading role in sustainable development. Water security is a key challenge worldwide. In recent years, new challenges from intensive urbanization and climate change have come to the fore. These challenges are intertwined with environmental, economic and social issues, which threaten the world's population and lead to an increased responsibility to improve the management of water resources in a sustainable way in order to ensure the life and future of the earth. Despite the efforts that have been made, water management is a cause for concern. Education can empower people in such a way that they become active agents of sustainable development themselves and this could be a fundamental step towards a better global future. The article seeks to highlight the necessity of water as a subject of environmental education and to state the conditions required for its successful implementation, in order to achieve awareness of natural resources and develop capacities for the sustainability of our global society.

Keywords: environmental education, water education, water management, sustainable development, water safety.

1. Introduction

The global community is called upon to effectively address several interrelated critical environmental issues, such as the climate crisis, the depletion of natural resources, the planet's energy future, waste management, air quality, biodiversity loss, pollution of the environment etc. The intractable problems facing the environment and, by extension, humanity, are inextricably linked to the pressures exerted by human activity on ecosystems and are related to the overexploitation and reckless use of natural resources.

“Water is the most critical natural resource in the world” (Ding & Ghosh, 2017). It is essential for life, ecosystems, social and economic development, but in a way that does not compromise environmental sustainability (Varis et al., 2008).

The lack of adequate and safe water in many regions of the planet and the inefficient management of natural

resources are major causes of mortality (Su et al., 2020). Risks related to water reach 90% of all natural risks worldwide and threaten human societies (Nazemi & Madani, 2018). Many countries have responded to water crisis, however, water reforms have not been a complete success, nor have they stopped the water crisis (Pahl-Wostl, 2020) that condemns billions of people to a perpetual struggle for survival.

A global population that does not understand the dimensions of the water crisis and does not have sufficient capacities to deal with it, according to the report of the World Water Assessment Program (WWAP), is a brake on taking timely measures (Araya et al., 2006).

Sustainability requires “environmental citizens”, knowledgeable and motivated individuals to address the water and other challenges of our rapidly changing planet. It is vital that citizens are deeply aware of environmental issues, their complexity, and have values and behaviors that promote a sustainable lifestyle (Martínez-Borreguero et al., 2020a).

2. Water management

Effective management of water resources can ensure food production, reduce poverty and eliminate water-related diseases (Ding & Ghosh, 2017). The maintenance of the quantity and quality of water resources is proposed as a means to deal with various challenges (Ding & Ghosh, 2017) in the context of the pressure that exists.

The critical importance of water for human health, but also for development and well-being has resulted in specific water-related goals being proposed. Goal 6 of the 17 Sustainable Development Goals (SDGs) of the United Nations calls for ensuring that sustainable water supplies are globally available, including water accessibility, pollution control, efficiency and restoration of natural resources (UN, 2017).

In order for this goal to be achievable, an integrated water management is required, which will cover the entire water cycle. Water security plays a key role in this approach, the aim of which is to ensure the quantity of water, the quality of water and the prevention of risks related to water (Li et al., 2020).

Water management cannot be implemented only with technical measures, such as those envisaged in their integrated, sustainable, adaptive or intelligent management. It is necessary to make parallel changes in people's values and attitudes about water use (WWAP, 2012; Ouda et al., 2013). Education for Environmental Sustainability or Education for Sustainable Development (ESD) can contribute to this goal.

Investing in education is key to finding optimal solutions. It seeks to develop an environmental culture and chart a sustainable future, taking into account the knowledge, attitudes, behaviors and values associated with the environment. It can therefore play a critical role in transforming beliefs and habits that promote sustainable resource management (Amahmid et al., 2018) and in the continued ability of citizens to respond effectively to future challenges. Education can help sustain the vision of safe, clean water for all.

3. Education for the sustainability of water resources

3.1 Education for Sustainable Development

Imposing legislative restrictions does not have the same response to people as education (Hoy & Stelli, 2016). Through education it is possible to provide knowledge and skills, increase awareness, develop positive attitudes and change behaviours (Briggs et al., 2018; Alkaher & Gan, 2020).

Economic development is required to interact in harmony with environmental protection and social well-being and for the international scientific community, this is what the ESD seeks to ensure (D' Adamo et al., 2021). ESD is described as *"the process through which individuals and society build social values, knowledge, skills, attitudes and abilities, aimed at preserving the environment, a common good, essential for quality of life and sustainability"* (Piccoli et al., 2016; Wang et al., 2019). ESD contributes decisively to the formation of active and aware citizens through the acquisition of better knowledge of the environment and the transformation of this knowledge into environmentally responsible action.

Integrating the principles of environmental sustainability at all levels of education is imperative and is reflected in the 2030 Agenda for Sustainable Development and the European Green Deal. Sustainability as a new goal of education requires all citizens to have a "sustainability mindset" and "environmental literacy", i. e. to realize that human action puts pressure on the environment and to act responsibly in order to ensure the future of the planet (EC, 2022).

3.2 Water education and implementation conditions

"The development of environmental education programs is a global necessity and can become a powerful tool for building sustainable societies" (Contreras et al., 2008; Zsoka et al., 2013). Water education is fundamental to promoting social awareness oriented towards sustainable water management. This can be realized through the inclusion in the school programs of *"water education"* and *"water culture"* subjects (Sammel et al., 2018, Khiri

et al., 2022), subjects that are water safety tools for the new generation.

Water is a source of life and therefore an important issue for ESD. Involving the educational community in sustainable development and teaching it from a sustainable perspective can help raise awareness so as to form values for nature and the environment and promote sustainability in water management. (Gozalbo et al., 2019; Olmos-Gómez et al., 2019; Estrada-Vidal et al., 2020). Attitude change *"should be systematically initiated and defined as the responsibility of the educational system"* (Martínez-Borreguero et al., 2020b).

The school is a suitable environment for the implementation of educational strategies, which aim to achieve sustainable attitudes and behaviors regarding the management of water resources, as well as to create citizens with responsible action (Gopinath, 2014).

According to the European Commission's Report for 2022, the existence of national planning and implementation strategies is a key factor for the best implementation of ESD. A clearly defined national policy with specific objectives and actions helps to implement ESD (EC, 2022).

Successful education for water resource sustainability also involves the participation of teaching staff with knowledge, skills and adequate training, specific teaching programs with specific learning objectives, sustainable learning environments, collaboration with communities, adequate assessment tools, sufficient available resources (funding, time, materials) but above all it requires incorporating visions for sustainability (EC, 2022). It must be a comprehensive and interdisciplinary approach at all stages of the educational process culminating in a supportive environment and culture for learning.

Conclusion

Nowadays, society appears to be more aware of environmental protection issues, yet environmental problems still remain unsolved, as people remain inactive (Potter, 2009). Environmental and social challenges show the need to change the way of life in society. Therefore, the formation of active citizens through education emerges as an imperative necessity.

Education plays an important role in building balanced societies that will be developed based on the pillars of sustainable development. ESD aims to empower people to contribute to sustainable development.

Water is a fundamental condition for life. Water scarcity and pollution are key challenges of sustainable development, so water is an ideal topic for ESD, which can lead to awareness and sustainable behaviors regarding its management (Michelsen et Rieckmann, 2015).

In such a context, ESD must include policy and vision for sustainability in educational strategies, pedagogy and learning environment, monitoring processes and cross-sectoral partnerships and collaborations. Change must be political and institutional (EC, 2022).

Supportive institutional leadership is key to developing environmentally literate citizens, advocates for environmental sustainability and prudent water use. Deliberate and holistic processes and mechanisms in the design, implementation and monitoring of educational programs will achieve broad reach and sustained long-term impact on sustainable development.

References

- Alkaber, I. and Gan, D. (2020), The role of school partnerships in promoting education for sustainability and social capital. *The Journal of Environmental Education*, **51**(6), 416–433.
- Amahmid, O., El Guamri, Y., Yazidi, M., Razoki, B., Kaid Rassou, K., Rakibi, Y., ... El Ouardi, T. (2018), Water education in school curricula: impact on children knowledge, attitudes and behaviours towards water use. *International Research in Geographical and Environmental Education*, 1–14.
- Araya, Y. N. and Moyer, E. H. (2006), Global Public Water Education: The World Water Monitoring Day Experience. *Applied Environmental Education & Communication*, **5**(4), 263–267.
- Briggs, L., Krasny, M. and Stedman, R.C. (2018), Exploring youth development through an environmental education program for rural indigenous women. *The Journal of Environmental Education*, **50**(1), 37–51.
- Contreras, K.; Contreras, J.; Corti, M.; De Sousa, J.; Durán, M.; Escalante, M. El Agua Un Recurso Para Preservar; Universidad de Los Angeles: Mérida, Venezuela, 2008.
- D' Adamo, I., Gastaldi, M., Imbriani, C. and Morone, P. (2021), Assessing regional performance for the Sustainable Development Goals in Italy. *Sci. Rep.*, **11**, 24117
- Ding K. and Ghosh S. (2017), Sustainable Water Management. A Strategy for Maintaining Future Water Resources. Encyclopedia of Sustainable Technologies, University of Technology Sydney, Ultimo, NSW, Australia.
- Estrada-Vidal, L.I., Olmos-Gómez, M.D.C., López-Cordero, R. and Ruiz-Garzón, F. (2020), The Differences across Future Teachers Regarding Attitudes on Social Responsibility for Sustainable Development. *Int. J. Environ. Res. Public Health*, **17**, 5323.
- EC, (2022). Education for environmental sustainability: policies and approaches in European Union Member States Final Report, Publications Office of the European Union, Luxembourg.
- Gopinath, G. (2014), A study on the environmental awareness among secondary school students in a district of Kerala State. *International Journal of Education and Psychological Research*, **3**(2), 54 – 57
- Gozalbo, M., Ramos, G. and Vallés, C. (2019), Huertos universitarios: Dimensiones de aprendizaje percibidas por los futuros maestros. *Enseñanza De Las Cienc.*, **37**, 0111-127
- Hoy, L. and Stelli, S. (2015), Water conservation education as a tool to empower water users to reduce water use: *Water Supply*, **16**(1), 202–207.
- Khiri F, Benbrahim M., Rassou K., Amahmid O., Rakibi Y, Guamri Y, Mohamed Itouhar M., Mrabet N., Yazidi M., Razoki B., Badri A. (2022). Water education and water culture in curricula for Primary, Middle and upper Secondary school levels", Australian Journal of Environmental Education, Cambridge University Press.
- Li J., Yang X. and Sitzenfrie R. (2020), Rethinking the Framework of Smart Water System: A Review. *Water*, **12** (2), 412.
- Martínez-Borreguero, G., Maestre-Jiménez, J., Mateos-Núñez, M. and Naranjo-Correa, F. L. (2020a), An Integrated Model Approach of Education for Sustainable Development: Exploring the Concepts of Water, Energy and Waste in Primary Education. *Sustainability*, **12**(7), 2947.
- Martínez-Borreguero, G., Maestre-Jiménez, J., Mateos-Núñez, M., and Naranjo-Correa, F. L. (2020b), Water from the Perspective of Education for Sustainable Development: An Exploratory Study in the Spanish Secondary Education Curriculum. *Water*, **12**(7), 1877.
- Michelsen, G. and Rieckmann, M. (2015), The Contribution of Education for Sustainable Development in Promoting Sustainable Water Use. In: Leal Filho, W., Sümer, V. (eds) Sustainable Water Use and Management. Green Energy and Technology. Springer, Cham.
- Nazemi A. and Madani K. (2018), Urban water security: Emerging discussion and remaining challenges. *Sustainable Cities and Society*, **41**, 925-928.
- Olmos-Gómez, M.D.C., Estrada-Vidal, L.I., Ruiz-Garzón, F., López-Cordero, R. and Mohamed-Mohand, L. (2019), Making future teachers more aware of issues related to sustainability: An Assessment of best practices. *Sustainability*, **11**, 7222.
- Ouda, O.K.M., Shawesh, A., Al-Olabi T., Younes, F., and Al-Waked, R. (2013), Review of domestic water conservation practices in Saudi Arabia. *Applied Water Science*, **3**, 689–699.
- Pahl-Wostl, C. (2020), Adaptive and sustainable water management: from improved conceptual foundations to transformative change. *International Journal of Water Resources Development*, 1-19.
- Piccoli, A. de S., Kligerman, D. C., Cohen, S. C., and Assumpção, R. F. (2016), A Educação Ambiental como estratégia de mobilização social para o enfrentamento da escassez de água. *Ciência & Saúde Coletiva*, **21**(3), 797–808.
- Potter, G. (2009), Environmental Education for the 21st Century: Where Do We Go Now? *The Journal of Environmental Education*, **41** (1), 22-33.
- Sammel, A., McMartin, D. and Arbuthnott, K. (2018), Education agendas and resistance with the teaching and learning of freshwater and extreme freshwater events. *Australian Journal of Environmental Education*, **34**(1), 18–32.

- Su Y., Gao W., Guan D. and Zuo T. (2020), Achieving Urban Water Security: a Review of Water Management Approach from Technology Perspective. *Water Resources Management*, Springer Nature B.V., **34**: 4163-4179
- UN (2017). The Sustainable Development Goals Report 2017, United Nations General Assembly, New York
- UN WWAP (World Water Assessment Programme), (2012). Understanding uncertainty and risks associated with key drivers. In: United Nations world water development report 4 - managing water under uncertainty, vol 1. UNESCO, Paris.
- Varis, O., Keskinen, M. and Kummu, M. (2008), Mekong at the crossroads. *AMBIO J. Hum. Environ.*, **37**, 146–149.
- Wang, Y.-H., Chang, M.-C. and Liou, J.-R. (2019), Effects of water-saving education in Taiwan on public water knowledge, attitude, and behavior intention change. *Water Policy*.
- Zsóka, Á., Szerényi, Z.M., Széchy, A. and Kocsis, T. (2013), Greening Due to Environmental Education? Environmental Knowledge, Attitudes, Consumer Behavior and Everyday pro-Environmental Activities of Hungarian High School and University Students, *J. Clean. Prod.*, **48**, 126–138.