

# Water resources management in education for sustainable development

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## Abstract

Issues relating to water resources are included among the most serious environmental problems. Pollution and deterioration of the receiving surface water and groundwater, mainly from human activities, pose an immediate threat to natural ecosystems and the functions of biosphere reserves, the balance of which is a prerequisite for the survival of every life form on the planet. In this light, the aim of the current study is to record second grade high school Rhodes students' knowledge of matters concerning water. For the purposes of the investigation, a questionnaire was used consisting of 19 main questions, which was distributed to 292 students. The survey results indicate a general lack of adequate knowledge in matters relating to pollution and water scarcity, as well as ways of dealing with them, and managing water resources. These data require the development of appropriate teaching interventions in education for sustainable development. This teaching procedure can contribute to the formation of active citizens, with knowledge, sensitivity and willingness to defend the right to life by preserving and maintaining healthy aquatic systems for the present and the future of humanity.

**Keywords:** Water resources management, education for sustainable development.

## 1. Introduction

The Earth's population of 7.0 billion in 2011 (United Nations, 2014) is estimated to reach 8.6 billion people in 2030 (United Nations, 2017). In this situation, the world water crisis, according to some scientists, is compared to the problem of climate change, which concerns intensely the international community, especially in recent years (Urry, 2015; Crate & Nuttal, 2016; Pecl et al., 2017; Cianfrani et al., 2018; WHO, 2019). These two problems are affected by overpopulation and rapid economic growth rates. Such a population increase demands quantities from the same finite available stock on the planet for use in agriculture, industry, tourism, etc. (Awange & Kyalo Kiema, 2019). Furthermore, degradation of groundwater and surface water (Garcia-Caparrós et al., 2017) caused by fertilizers and pesticides, with possible human health implications (Cramer et al., 2018), adds to the list. Urban waste water, nitrate and industrial waste are also

factors that significantly affect water bodies (Josep & Mencia, 2019).

In this complex domain of water issues, and with the likelihood of 2 billion people experiencing a shortage of freshwater (United Nations, 2015) by 2050, it becomes clear that the changes required in modern, global, technological fast developing societies, demand immediate substantial solutions to address the increasing and complex problems that afflict humanity (Georgopoulos et al., 2014; Tzaberis et al., 2014). Based on the targets set about water in Agenda 2030, solutions such as desalination systems (Missimer et al., 2014), rainwater collection (Ward et al., 2017), exploitation of recovered water (Zekri et al., 2014), etc. In this light, the aim of the current paper is to explore the knowledge of Rhodes high school students on issues related to water resources, with the ultimate aim of the findings serve as a tool for designing appropriate educational interventions in the framework of education for sustainable development.

## 2. Methodology

The methodology used is empirical quantitative and in situ. For the research, the appropriate parameters were taken into account to meet its purpose and objectives (Bryman & Bell, 2015). As a means of collecting data, the questionnaire was selected, which was formulated appropriately so that the questions were clear, be brief and comprehensive in order to accurately record the knowledge of the sample (Cohen et al., 2011). The themes in which the questions were raised were environment, water scarcity, water pollution and how to deal with them.

## 3. Results

From the results of the survey, with regard to the knowledge of the sample on the water pollution factors, the cattle breeding is recorded with an average of 3.33, agricultural crops with 3.18, drought with 3.16, urban wastewater with 1.58, and industry with 1.33.

In the case of liability for water pollution, they declare the engineers with an average of 2.53, lawmakers with 2.17, politicians with 2.06, citizens with 1.97, hoteliers with 1.81, and industry with 1.00.

Summarizing the options for assessing their knowledge on water scarcity, the use of recovered water for green spaces and fire extinguishing is recorded with an average of 3.35, water saving with 2.53, water sufficiency in their island with 2.51, water cycle with 2.50, and sources of water pollution with 2.48.

In relation to water scarcity in an area, they hold accountable the citizens with 46.9% and at lower rates between 1.1% and 5.1% the politics, the media, the economy, etc. A large percentage (38.0%) did not respond. In high proportion (39.7% and 34.2%) they "totally agree" or just "agree" that stricter penalties should be imposed on those responsible for water pollution. They state that water scarcity can be addressed if citizens reduce water wasting (65.8%) and pollution (29.8).

In the hypothetical question that in the future there may be conflicts mainly for: oil, food, wealth, water and energy, among the "right-wrong" options, the highest percentage is attributed to water and oil by 60.6% and 57.2 % respectively.

For the effects of dumping waste water at sea, the majority of students (75.3%), among the "right-wrong" choices, rightly mention the disruption of marine biodiversity, as well as with 74.9%, wrongly, the impacts on health from infectious diseases. It is noteworthy that for the treatment of urban waste water, the majority (72.6%) does not know, compared to 26.7% about the operation of the waste water facilities, while by the justification of the replies it is observed that only 17.8% adequately know about their importance.

#### 4. Conclusions

From the survey results analysis, it is observed that the majority of students have significant deficiencies and misunderstandings in their knowledge of water quality and water sufficiency on the island of Rhodes. Students seem to know that urban wastewater is a factor that pollutes the planet to a significant extent. They also recognize as a consequence the disruption of marine biodiversity and the negative effects on health from dumping untreated waste water into the sea. In addition, they believe they have knowledge about water scarcity, which concerns water sufficiency, saving and recovery. Few individuals of the sample seem to know that future conflicts will take place for water, that citizens' behavior can cause water scarcity in an area, and very few know about the possibility of recycling wastewater.

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