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A Review of Sustainable Water Practices: Teaching High School Students to Manage and Purify Water for Daily Needs

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ABSTRACT

Access to clean and safe water is a fundamental human need, yet millions of people around the world still lack reliable sources of potable water. Educating high school students about sustainable water practices is crucial to ensuring that future generations are equipped to manage and purify water resources effectively. This review examines the importance of teaching water management and purification to high school students, with a focus on practical, low-cost methods that can be implemented using simple tools and techniques. The review explores various hands-on approaches to water education, including basic water quality assessment, filtration methods, and affordable purification technologies such as sand filtration, boiling, and solar disinfection. It also highlights the pressing global issue of water scarcity, noting that over 2 billion people still rely on unsafe drinking water sources. In addition to theoretical knowledge, students engage in fieldwork and laboratory experiments, where they test and treat local water sources, gaining practical experience with real-world water challenges. By the end of the program, students are equipped with the knowledge and skills to identify safe water sources and apply basic treatment methods for daily use, such as drinking, cooking, bathing, and sanitation. The initiative aims to foster environmental awareness, encourage responsible water use, and promote community-driven solutions to water scarcity and contamination, empowering students to contribute to sustainable water practices in the future.

INTRODUCTION

Water is an indispensable resource for sustaining life, yet its availability and quality are facing growing threats due to climate change, over-extraction, pollution, and population growth. The United Nations reports that over two billion people live in regions experiencing high water stress, and more than 785 million people globally lack access to safe drinking water. As the demand for freshwater increases and environmental degradation continues to intensify, the need for sustainable water practices has become more urgent than ever. Water scarcity and contamination are no longer distant challenges confined to developing countries; they are pressing issues affecting communities worldwide, including in developed nations where infrastructure, urbanization, and climate change are placing strain on existing water systems. Access to clean, safe water is not just a matter of public health, but also of environmental sustainability and social equity. In this context, it is crucial to educate young people, particularly high school students, on water management and purification. By equipping students with knowledge and practical skills in sustainable water practices, we can nurture a generation of environmentally conscious individuals capable of addressing water scarcity, pollution, and conservation (Middlestadt et al., 2001).

While the importance of water education is widely acknowledged, there is still a notable gap in the research on effective teaching strategies for high school students regarding sustainable water practices. Most existing literature on water education focuses on general environmental education or public awareness campaigns centered around water conservation. However, there is limited research exploring how to engage students in practical, hands-on activities that teach real-world water management and purification skills. Current water education programs tend to focus primarily on theoretical concepts, such as the water cycle, causes of water scarcity, and basic conservation techniques. While these topics are essential, they often fail to highlight actionable steps students can take in their daily lives to manage and purify water. Furthermore, there is a lack of studies addressing how high school curricula can integrate not only the science behind water purification and conservation, but also the social, economic, and political factors that influence water access and management. This is especially critical, as issues of water scarcity and contamination are deeply connected to broader concerns of social justice, equity, and governance (Jasper et al., 2012). The Web of Science data with the keyword "Environmental Education" shows the position of Figure 1(a) illustrating the status of water resources at the research area level, where there are still limited studies connecting water resource issues with environmental education. In contrast, Figure 1(b) highlights that water treatment is the most searched subject in this field, largely because it is widely cited in relation to environmental education, reflecting its prominence in academic discussions. This demonstrates a significant gap in the integration of water resources and management within the broader context of environmental education, which is a crucial area for further exploration.

This review aims to address these gaps by exploring the potential for developing a comprehensive framework for teaching sustainable water practices in high schools. The proposed framework focuses on combining theoretical knowledge with hands-on, experiential learning to foster a deeper understanding of water-related issues. Unlike traditional methods that treat water education as a purely academic subject, this approach emphasizes the practical application of techniques such as rainwater harvesting, filtration, and local water treatment. Moreover, the review examines the importance of integrating social, political, and economic perspectives into water education, helping students understand how societal factors impact water access and quality. This interdisciplinary approach enhances students' technical knowledge while developing critical thinking skills related to water governance, equity, and policy. Additionally, the review explores the effectiveness of project-based learning (PBL), collaborative activities, and experiments in promoting sustainable water practices. By equipping students with both knowledge and practical skills, this framework aims to prepare them to become proactive stewards of water resources, contributing to global efforts to address water challenges in an increasingly water-scarce world (Zaharani et al., 2011; Ferk Savec & Mlinarec, 2021; Rustamova, 2023).

MATERIALS AND METHODS

This review of sustainable water practices, specifically focusing on teaching high school students to manage and purify water for daily needs, follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. PRISMA is a widely recognized framework used to ensure transparency, rigor, and consistency in systematic reviews. The methodology employed in this review aimed to synthesize the existing literature on educational practices and water management strategies, with a particular emphasis on sustainable techniques (Sarkis-Onofre et al., 2021; Albhirat et al., 2024). Additionally, this review explores the effectiveness of various teaching methods and identifies best practices for implementing sustainable water management education in curricula.

1. Eligibility criteria

The eligibility criteria for this review included studies, reports, and educational resources published in peer-reviewed journals, books, or gray literature that focused on water management and purification practices. The primary inclusion criteria were: (1) The study or resource must involve high school students (ages 12-18); (2) The content must address sustainable water management, conservation, or purification techniques; (3) The teaching method must be relevant to educational settings, including formal or informal high school curricula, project-based learning, and field-based education; (4) The study must be published in English, with no time limit placed on publication dates; (5) Studies that focused on general water education without specific emphasis on sustainability or high school students, as well as non-peer-reviewed materials (e.g., opinion pieces or reports lacking research backing), were excluded. Furthermore, studies that did not provide measurable outcomes related to the educational impact of the water management practices or lacked a clear description of teaching methodologies were also excluded. This ensured that only studies with substantial educational contributions to the teaching of sustainable water practices in high school settings were included in the review. The goal was to identify evidence-based approaches that could be replicated or scaled in other educational contexts to enhance water literacy and sustainability education.

Figure 1. The Web of Science data with the keyword "Environmental Education" shows the position of (a) the status of water resources at the research area level and (b) water treatment for the most cited scope

(a)

166,852 Environmental Sciences Ecology	57,967 Science Technology Other	26,017 Physics	21,711 Biochemistry, Molecular, Biology
96,804 Engineering	47,504 Materials Science	25,943 Energy, Fuels	13,844 Toxicology
92,363 Chemistry	40,234 Chemistry	23,973 Water Resources	13,135 Marine Freshwater Biology
	26,874 Geology	23,655 Agriculture	12,457 Microbiology

(b)

22,236 Herbicides, Pesticides, Ground Poisoning	18,866 Soil Science	14,963 Electrochemistry	11,773 Crop Science
19,593 Marine Biology	17,385 Bioengineering	14,694 Contamination, Phytoremediation	7,872 Catalysis
18,923 Water Treatment	16,186 Forestry	13,981 Environmental Sciences	7,386 Nanoparticles
	15,648 Oceanography	13,826 Sustainability Science	7,287 Climate Change

2. Information sources

Data was gathered from multiple sources, including academic databases such as Google Scholar, JSTOR, (Journal Storage), ERIC (Education Resources Information Center), Scopus, and Web of Science. Additional sources were identified by reviewing reference lists of relevant articles and books. The search terms used included combinations of “sustainable water management”, “high school students”, “water purification education”, “environmental education”, “water conservation”, and “project-based learning”.

3. Study selection

The study selection process followed the PRISMA flow diagram, starting with an initial pool of 350 articles and reports identified from the selected databases. After removing duplicates, 280 articles remained for screening. Titles and abstracts were reviewed to assess relevance to the research question, with particular attention paid to the focus on high school education, water sustainability, and teaching methodologies. Full-text articles from the remaining 50 studies were then examined for detailed eligibility, including factors such as sample size, study design, and educational outcomes. Studies that did not meet the inclusion criteria were excluded at this stage. After this process, 31 articles were included in the final review. These studies were carefully analyzed for their contributions to the topic, focusing on the effectiveness of different teaching strategies, the types of water management techniques taught, and the impact on student engagement and learning outcomes (Yusop et al.., 2022).

4. Data extraction

Data from the included studies were extracted based on key aspects relevant to the research question: teaching methods, types of water management practices, sustainability approaches, and educational outcomes. Key data points included study design, sample size, educational interventions, teaching strategies, and measurable impacts on student knowledge, attitudes, or behavior related to water conservation, purification, and sustainability practices. Attention was also given to context-specific variables such as cultural, geographic, and socio-economic factors influencing outcomes. This data helped identify effective teaching practices and assess their influence on students' understanding, attitudes, and actions regarding water sustainability, conservation, and purification techniques in real-world contexts, thereby guiding future educational strategies and implementations (Acosta Castellanos & Queiruga-Dios, 2022; Gutierrez-Bucheli et al., 2022; Albhirat et al., 2024).

5. Synthesis of results

The synthesized data were analyzed to identify common themes, successful educational approaches, and potential gaps in the literature. Particular attention was paid to studies that involved active, hands-on learning methods, such as project-based learning, experiments, or real-world applications, as these have been shown to be most effective in engaging students and enhancing their understanding of sustainable practices. The results were categorized into two main areas: educational strategies for teaching water sustainability and specific water purification techniques implemented in educational settings. The findings were summarized in narrative form to highlight trends and best practices for high school curricula aimed at water management education (Yusop et al.., 2022; Ardoin et al., 2023).

RESULTS AND DISCUSSION

Educational Context for Water Sustainability in High Schools

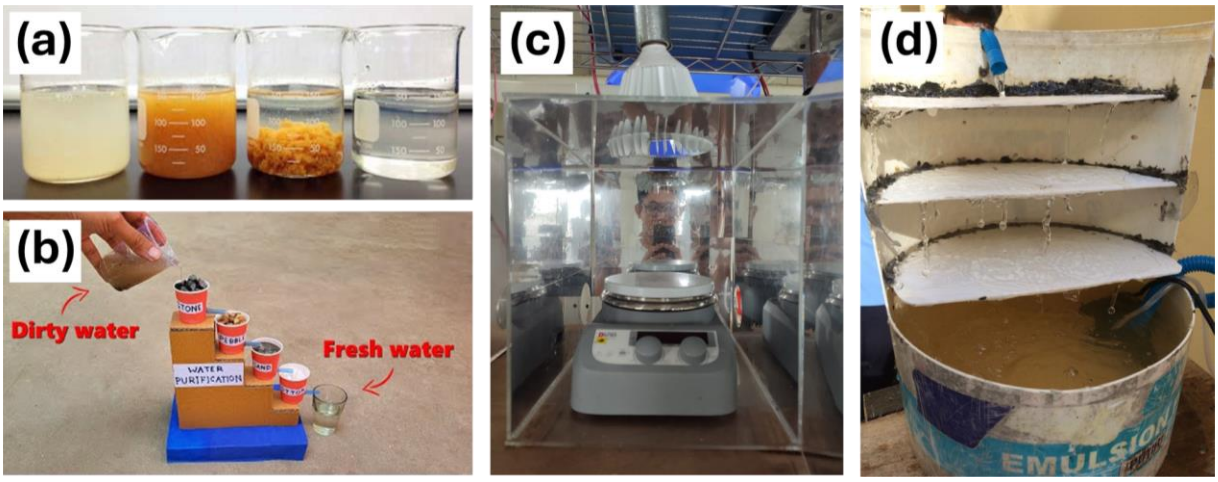
Water management has become an increasingly relevant global issue, with water crises affecting various regions around the world. Water pollution has become one of the critical challenges exacerbating this crisis, threatening human health, ecosystems, and the sustainability of natural resources (see Figure 2). As such, education on water management and purification should be introduced at an early stage, especially at the high school level. Research conducted by several studies has shown that providing students with a solid understanding of water sustainability can foster greater awareness of water conservation and encourage them to adopt more responsible water use behaviors in their daily lives. A key finding in the literature is that teaching concepts such as the hydrological cycle, water pollution, and purification methods has the potential to influence students' attitudes and behaviors toward water use and management. Additionally, involving students in hands-on activities, such as water purification experiments, can deepen their understanding of simple, practical methods to manage water quality within their communities. While these methods are relatively simple, real-world applications require a deep understanding of water quality issues and the processes involved in purification. Therefore, it is crucial for educators not only to teach these techniques but also to provide a broader context regarding the challenges faced in purifying water on a larger scale, particularly when dealing with more complex contamination (KarataŞ & KarataŞ, 2016; Dey et al., 2021; Kılıç, 2021).

Figure 2. Source of water pollution.

Water Purification Techniques Taught in Educational Curricula

Most high school water purification education programs involve hands-on experiments. Research by Covitt et al. (2009) identifies several purification techniques commonly incorporated into the high school curriculum. These techniques include coagulation-flocculation, multi-stage filtration, photocatalysis, and oxidation processes (Figure 3(a)-(d)). Findings from the literature review suggest that these practical techniques not only enhance students' understanding of water quality but also teach basic environmental science principles. One of the key advantages of using these simple water purification experiments is that students can directly observe how contaminants are removed from water using readily available materials, such as sand, charcoal, or other natural and synthetic substances (Oyewo et al., 2022). However, while these methods are useful for basic water purification, their application in real-world settings requires a deeper understanding of water quality and the complexities of waterborne contaminants. Therefore, it is important for educators to provide both practical demonstrations and theoretical background on how water purification works on a larger scale, especially when dealing with more complex contamination (Cosgrove & Loucks, 2015; Anderson et al., 2019; Singha et al., 2022).

Figure 3. Some simple water treatment technologies that can be applied at the high school student level include: (a) coagulation-flocculation, (b) multi-stage filtration, (c) photocatalysis, and (d) oxidation process



Source: (a) Genesis Water Tech, 2019; (b) Genius Theory, 2024; (d) Andriyansyah, 2017)

The Role of Water Purification Education

In the modern era, education plays a significant role in teaching students about water management and purification. Several studies have shown that hands-on learning methods, such as simulations and practical experiments, can enhance students' understanding of water purification processes and the challenges involved in sustainable water management. For example, field activities that involve monitoring water quality allow students to observe changes in water conditions over time. Furthermore, engaging students in designing water purification solutions can inspire them to think creatively about how to address water quality issues in their local environments. For instance, some high schools have incorporated projects where students design simple, low-cost water purification systems using methods such as solar energy for heating water or natural filtration techniques. These types of projects not only support the learning process but also help students appreciate the real-world applications of science in solving environmental problems. Therefore, educators are encouraged to explore hands-on approaches that enhance water-related education and encourage students to innovate (Karthe et al., 2016; Martínez-Borreguero et al., 2020; Pozo-Muñoz et al., 2023; Hanley, 2024).

Introducing water treatment technologies at the high school level is a fundamental and crucial step before students engage in larger projects or studies. A strong understanding of the basic mechanisms of water treatment will equip them with the knowledge needed to design more complex solutions in the future. Therefore, it is important for educators to teach water treatment methods that can be understood and applied by students in a simple yet effective way. Some basic methods that are suitable for teaching at the high school level include (a) coagulation-flocculation, (b) multi-stage filtration, (c) photocatalysis, and (d) oxidation process. The coagulation-flocculation method, for example, can be taught in a simple way using household materials to demonstrate the process of binding dirt particles in water, so students can easily observe the changes taking place. Multi-stage filtration is also a technique that is easy to practice by using several layers of filtration materials, such as sand, activated charcoal, and gravel, which can be arranged in prototype form to show how water can be filtered step by step. Photocatalysis, although more technical, can be understood by students by explaining the basic principles of photochemical reactions using UV light and photocatalytic materials such as titanium dioxide to break down contaminants. Lastly, the oxidation process can be explained in an easy-to-understand way using substances like hydrogen peroxide to oxidize pollutants in water. By introducing these methods through simple prototypes, students will not only understand the theory behind water treatment but also see firsthand how these technologies work, which will strengthen their practical skills in designing water treatment solutions (Garrido-Barros, 2022; Zhang et al., 2018; Cescon & Jiang, 2020).

1. Coagulation-flocculation process

The coagulation-flocculation process is an important method in water treatment used to remove small particles, dirt, and other contaminants (Zhao et al., 2021). This process consists of two main stages: coagulation and flocculation. In the coagulation stage, a chemical substance called a coagulant is added to the water to disrupt the electrical charge on small dissolved particles, allowing these particles to bind together and form larger clumps. Common coagulants used are alum (aluminum sulfate) or ferric chloride. After coagulation, the water mixed with the coagulant enters the flocculation stage, where it is gently stirred to allow the combined particles to form even larger clumps or “flocs”. These flocs then settle to the bottom of the container or can be separated by other means, such as filtration, leaving cleaner water that can be separated from the contaminants (See Figure 4a).

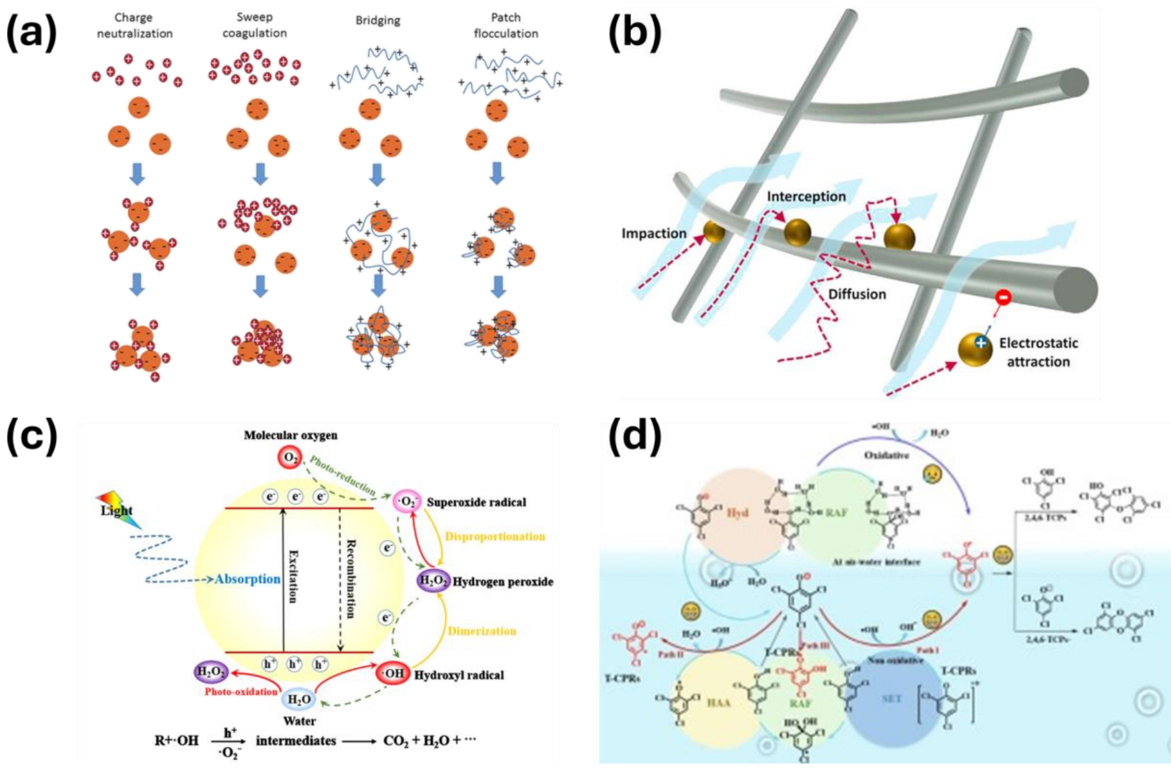
To help high school students understand and apply this process, they can conduct simple experiments using easily available materials. For example, students can prepare a container of murky water, such as water from a river or lake, and add a small amount of alum to start the coagulation process. After adding alum (about 1-2 grams per liter of water), students can stir the water quickly for 30 seconds and observe the changes in the water. Then, the water is stirred slowly for several minutes to allow larger flocs to form. After that, students can observe the flocs settling to the bottom of the container and separate the clean water using a filter or cheesecloth. This experiment allows students to see firsthand how coagulation-flocculation works to clean water, and they will understand the mechanism behind the process of how the coagulant disrupts the electrical charge of dissolved particles, causing them to clump together and settle. This experiment also provides students with the opportunity to understand the practical application of important water treatment techniques in the real world, while deepening their understanding of the processes in water purification.

2. Multi-stage filtration/adsorption process

The multi-stage filtration/adsorption process is a water treatment technique that uses several stages of filtration to remove impurities, contaminants, and harmful substances from water (Johir et al., 2016). Essentially, this process involves the use of various filtration media selected based on pore size and adsorption capacity to capture smaller particles. The process consists of several complementary stages, starting with coarse filtration to remove larger particles, followed by finer filtration to capture smaller particles, and ending with adsorption to remove dissolved contaminants, such as heavy metals, organic compounds, or chemical substances. In the initial stage, water passes through coarse filtration media, such as gravel or sand, which removes large particles like dust or plant debris. Next, the water passes through a finer media layer, such as fine sand or activated carbon, which can filter out smaller particles and adsorb dissolved substances. Activated carbon is highly effective in absorbing organic chemicals, odors, and unpleasant tastes, as well as removing certain heavy metals that may be present in the water. This process offers the advantage of producing cleaner, safer water using inexpensive and easy materials (See Figure 4b).

To help high school students understand and apply multi-stage filtration/adsorption, they can conduct a simple experiment using easily accessible materials, such as sand, gravel, and activated carbon for the filtration media. The first step is to prepare several containers and fill each with a different layer of filtration media. For example, the first layer could be filled with large gravel, the second with fine sand, and the third with activated carbon. Next, the murky water is poured into the first container, which will filter out larger particles. The filtered water then flows through the fine sand layer to remove smaller particles and finally passes through the activated carbon layer to adsorb dissolved chemicals. Students can observe the changes in color and clarity of the water after each filtration stage and record the results. This experiment not only allows students to understand the sequential filtration process but also provides insights into the principles of multi-stage filtration, as well as the importance of using the correct media. With this approach, students can more easily grasp the concepts of filtration and adsorption and their real-world applications (Karacaoglu & Özkaya, 2023).

Figure 4. (a) coagulation-flocculation, (b) filtration, (c) photocatalysis, and (d) oxidation mechanism



Source: (a) Suopajärvi, 2015; (b) Han et al., 2021; (c) Chuaicham et al., 2023; (d) Tang et al., 2024)

3. Photocatalysis process

The photocatalysis process is a method that uses light (typically ultraviolet or UV light) to accelerate a chemical reaction with the help of a catalyst. This process is highly effective in breaking down pollutants, such as harmful chemicals, heavy metals, and organic compounds in water or air, through a photochemical reaction (Mishra & Sundaram, 2023). The basic principle of photocatalysis involves the use of a catalyst that becomes active when exposed to light. For example, titanium dioxide (TiO2) is one of the most widely used catalysts in this process. When TiO2 is exposed to UV light, the energy from the light activates the surface of the catalyst, producing reactive species such as free radicals and oxygen ions. These free radicals are highly reactive and can break down pollutant molecules into safer, harmless compounds like water and carbon dioxide. Photocatalysis is very useful for addressing water and air pollution because it can break down contaminants without generating harmful waste by-products. Additionally, this process can be carried out at room temperature and does not require the use of additional chemicals, making it an environmentally friendly and efficient process (See Figure 4c).

To help high school students understand and apply the photocatalysis process, they can conduct a simple experiment using readily available materials. For example, students can use titanium dioxide (TiO2) as the catalyst and UV light from an ultraviolet lamp to activate it. The first step is to prepare a container with water that contains pollutants, such as ink or water-soluble dyes. Next, a thin layer of TiO2 is placed on the surface of the water or on a supporting material such as glass. The UV lamp is then turned on above the container to expose the TiO2 to ultraviolet light. During the experiment, students can observe the color change in the water, indicating that the pollutants are being broken down. To facilitate understanding, students can record the time it takes for the decomposition process and the changes occurring in the pollutants. This photocatalysis process can be explained by showing that the energy from the UV light activates TiO2, which then generates free radicals that break the chemical bonds in the pollutant molecules, transforming them into simpler, harmless substances. This experiment allows students to see firsthand how photocatalysis works to address pollution and provides a practical example of the application of environmentally friendly technology in solving environmental issues, particularly in water and air purification. Through this experiment, students will gain a better understanding of the photocatalysis mechanism, as well as basic concepts such as catalysts, free radicals, and the photochemical reactions that occur during the process.

4. Aeration process

The aeration process is a method of water treatment that involves the use of oxygen to enhance the removal of contaminants. Unlike the oxidation process that directly relies on chemical reactions with oxygen, aeration focuses on increasing the dissolved oxygen levels in water, which helps improve water quality by facilitating the removal of unwanted substances. Skouteris et al. (2020) explain that by introducing oxygen into water, typically through aeration techniques like bubble diffusion or surface aerators, contaminants such as dissolved gases (e.g., carbon dioxide) and volatile organic compounds can be expelled. In addition, aeration also promotes the oxidation of substances like iron (Fe) and manganese (Mn), converting them into forms that are easier to remove. One effective way to enhance aeration is by using a multi-stage tray system, which increases the contact between water and oxygen. In this system, contaminated water flows through a series of trays arranged in layers, with each tray acting as a zone for improved oxygen absorption. As water passes through each tray, air or oxygen is introduced, typically in the form of small bubbles. This increases the amount of dissolved oxygen in the water, thereby improving the efficiency of the aeration process. This method is commonly used in both drinking water and wastewater treatment to reduce heavy metals, improve water clarity, and remove organic compounds (See Figure 4d).

To help high school students understand and apply the oxidation process using multi-stage trays, they can conduct a simple experiment using easily accessible materials. The experiment can begin by preparing several transparent containers and adding water mixed with substances that are easily oxidized, such as a solution of potassium permanganate (KMnO4). Students can then create a multi-stage tray system using several stacked containers, connected to allow water to flow from one tray to the next. In this experiment, students can use a small pump to circulate the water through the stacked trays. In each tray, students can introduce air using an air pump or air bubbles to increase the contact between air and water, which accelerates the oxidation reaction. Students can observe the color change of the water at each stage of the tray, which indicates the ongoing oxidation process. To facilitate understanding, students can record the color changes in the water that reflect the oxidation reaction, as well as the time it takes to observe these changes. Through this experiment, students will gain a better understanding of how oxygen plays a role in the oxidation process and how the multi-stage tray system enhances aeration efficiency in water treatment. This experiment provides a practical demonstration of how oxidation works to remove contaminants and introduces important concepts in environmentally friendly water treatment.

Impact of Education on Students' Water Use Behavior and Attitudes

One of the main goals of teaching water management and purification at the high school level is to shape students' behavior and attitudes toward water use. Various studies have assessed the impact of water sustainability education on students' everyday actions, and the results indicate that students who are educated about water management tend to use water more efficiently and are more aware of the importance of maintaining water quality (Wangmo et al., 2024). Educational programs that combine theoretical learning with practical experiences such as teaching students to monitor their water usage or encouraging them to participate in local water conservation projects have proven to be effective in influencing long-term behavioral changes. Students who engage in such activities are often more likely to share their knowledge with family and friends, creating a ripple effect that can lead to broader community awareness and action. However, despite the positive impacts, the main challenge lies in maintaining students' interest in these topics after they leave school. Therefore, it is important to create programs that not only emphasize technical knowledge but also foster a sense of social responsibility and awareness (Wang et al., 2019; Keskin et al., 2020).

Student Involvement in Community Projects and Conservation Programs

Direct involvement in water conservation projects within their communities has proven to be an effective way to teach high school students the importance of sustainable water management. Various community-based programs that engage students such as cleaning local water sources or building simple water purification systems in areas lacking clean water access provide real-world experiences that can alter their perspectives on water usage and conservation. A study by Prayogo et al. (2023) showed that students involved in these projects not only develop technical skills but also improve their social and leadership abilities. These projects teach students how to work collaboratively, identify local water issues, and design practical solutions that can be implemented on the ground. Furthermore, engaging in these initiatives helps students understand the local and global context of water management and the broader impacts of water issues on society. Despite the benefits of such hands-on community projects, one challenge is the limited availability of resources and support in some schools. Therefore, governments and educational institutions need to offer greater financial and human resource support to make such initiatives more accessible and sustainable.

Challenges and Barriers in Implementing Water Purification Education in Schools

While education on water management and purification in high schools has many benefits, there are several challenges and barriers that need to be addressed. One of the main challenges is the lack of training and support for teachers to effectively deliver this subject. Many teachers feel unprepared to teach water purification topics, particularly if they do not have a background in environmental science or water-related fields. Additionally, limitations in school facilities can hinder the implementation of water purification experiments. For example, experiments that involve laboratory equipment and certain chemicals may not be feasible in schools with limited budgets or resources. Therefore, there is a need to develop more creative, resource-efficient approaches to water education, such as using local, readily available materials for purification experiments. Furthermore, the lack of external collaboration such as from governmental bodies, NGOs, and the private sector—can be a significant barrier to successful implementation. Thus, collaboration between schools, local communities, and various sectors is essential to overcome these obstacles (Kariuki et al., 2023; Prayogo et al., 2023; Suryawan et al., 2024).

CONCLUSION

Based on the findings from this literature review, teaching water management and purification in high school has great potential to shape students' attitudes toward water sustainability. Simple purification techniques and student involvement in water conservation projects provide valuable hands-on experience that enhances understanding of water quality and conservation. However, challenges such as resource limitations, teacher training, and external support must be addressed to ensure program success. Collaborations between educational institutions, government agencies, NGOs, and the private sector are essential to overcome these challenges. Recommendations for improving water education include providing teacher training, incorporating community-based projects into the curriculum, promoting the use of technology for water quality monitoring, strengthening partnerships with external organizations, and encouraging sustainable water practices in schools, such as water-saving campaigns and efficient infrastructure. By addressing these, high schools can play a key role in educating on water sustainability and preparing them to become responsible water stewards.

Future studies could explore the effectiveness of project-based learning or case studies in teaching sustainable water management to high school students. Research could also examine the long-term behavioral impacts of such educational programs on students' water-related habits. Additionally, collaboration between schools and organizations involved in water management could be further explored to create more comprehensive educational frameworks. Further research could also focus on developing specialized learning modules tailored to regions with specific water challenges, such as water scarcity or flood-prone areas, to enhance local relevance and impact.

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