

Water Sanitation and Hygiene (WASH): Merits and Demerits in schools

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Abstract:

This study explores the merits and demerits of Water Sanitation and Hygiene (WASH) in schools. WASH is crucial for maintaining health and preventing diseases in educational settings. The study highlights the importance of providing sufficient and safe water, basic sanitation, and hygiene facilities in schools. It also discusses the effects of poor WASH on education, including the spread of diseases, poor academic performance, and absenteeism. The study suggests improvements in WASH infrastructure, health education, and community involvement to promote healthy behaviors and environments in schools.

Keywords: WASH, water, sanitation, and hygiene, schools, children

Introduction

Water Sanitation and Hygiene (WASH) in schools is a critical aspect of promoting health, well-being, and academic performance among students. Schools play a vital role in shaping the minds and habits of future generations, and ensuring a safe and healthy environment is essential for optimal learning (Boyi, 2013; Bello, 2017). However, many schools, particularly in developing countries, face significant challenges in providing adequate WASH facilities and services, putting students at risk of waterborne diseases, poor hygiene practices, and related health problems (Ibrahim et al., 2019; Ogbuehi et al., 2020; Umar et al., 2021; Wali et al., 2022). This highlights the need for effective WASH interventions in schools to promote a healthy and supportive learning environment. The major objective of this study is to explore the merits and demerits of

Water Sanitation and Hygiene (WASH) in schools.

Basic Elucidations

Schools refer to nurseries, primaries, secondary, etc. Certainly, schools are considered among the topmost priorities that needed interventions in instilling WASH parameters, because they are used by a large part of the society. The WASH refers to an abbreviation for water, sanitation, and hygiene; while WASH in schools is another component championed in order to inculcate WASH policies and implementation in our schools. WASH in schools include the provision of sufficient and safe water, provision of basic sanitation and hygiene, and basic handwashing materials (Olukami, 2013; Salihu et al., 2017). The properties of WASH are delineated in Table 1.

Table 1: Some basic components of WASH in schools

S/N	WASH terminology	Meaning and description
1	Basic sanitation	Effectively separate human excreta from human contact, prevent the excreta from polluting the environment It consists of pit latrine and a slab (flush latrine, composting latrine). It is accessible to all users, maintain gender sensitivity and equity for instance by providing menstrual services, toilet for males, toilet for females, toilet for staff, toilet for students, and toilet that is sensitive to people with disability
2	Basic drinking water services	Water from an improved source deliver water sufficiently at all times for all the required purposes (eg

		personal hygiene, food preparation, laundry, and cleaning)
3	Hygiene parameters	Handwashing materials, water and soap at the latrine or nearby

Hygiene and its domains

Hygiene include or dubbed the practices and conditions that help someone to maintain health and prevent the spread of diseases. The hygiene may be in form of domains including personal hygiene, food hygiene, environmental hygiene, and water hygiene. Personal hygiene is a practice or behavior or an idea of caring for oneself and cleaning the hands, skin, eye, mouth, nose, clothes, beddings, and private body parts in order to diminish the risk of diseases. Handwashing with soap is a major stride that prevent diseases to a greater extent. Hands should be wash after toilet, after disposing feces, before cooking or eating or feeding (WHO?UNICEF, 2014; Norwegian Refugee Council, 2015; Winter et al., 2021).

Food hygiene refers to the methods of ensuring foods are clean and free from contamination or spoilage during all the stages (collection, storage, cooking, serving or preparation). Foodborne illnesses, such as *salmonella*, *E. coli*, hepatitis, taeniasis, poliomyelitis, cysticercosis, vibrio, and shigellosis are detrimental (Olatunji & Thanny, 2020).

Environmental hygiene consists of methods and strategies that ensure clean and free from vectors. It involves the solid waste management, vector control (such as blackfly, tsetse fly, mosquito, housefly, and

lice). Proper environmental hygiene helps in preventing disease, cleaning of the environment, preventing sickness, and hospitalization, as well as school absenteeism by students or staff (WHO, UK, 2011; UNICEF, 2012; Kanayochukwu et al., 2020).

Water hygiene refers to strategies that prevents pollution or contamination of water utilized at schools. Contamination of water cause diseases such as cholera, dysentery, typhoid, poliomyelitis, and many others. Issues such as animal droppings, run-off, leakage pipes, open defecation, poor waste disposal, open wells or tanks, oil spill, etc are reasons behind water contamination in schools (Azuogu et al., 2016). Therefore, measures to prevent water contamination in schools include, boiling of water, chemical treatment of water, disinfection, fencing of water sources, proper waste disposal, regular cleaning of storage, regular check-up of water storage and pipes for instance (Ngeno et al., 2022). Verily, water contamination leads to certain effects that cause diseases or hospitalization and consequently poor academic performance and absentia, and other militating factors in school (Zomerplaag & Moojiman, 2005). The Table shows some examples of diseases affecting students or staff die to poor WASH in schools.

Table 2: Some examples of diseases and respective effects caused by poor WASH in schools

		Examples	Effects
	Waterborne diseases	Diarrheal disease eg cholera, amoebiasis, hepatitis, typhoid, bacillary dysentery	Morbidity, mortality, hospitalization, poor academic performance, malnutrition, school absenteeism, dehydration
	Vector-borne diseases due to biting caused by insects like tsetse fly, mosquito	Malaria, yellow fever, river blindness, filariasis, bilharzia	Poor growth, tiredness, sicknesses, school absenteeism, mortality, morbidity
	Water related diseases occur due to shortage of safe water	Example include scabies, trachoma, skin infections	Morbidity, hospitalization, school absenteeism

Demerits of poor WASH in schools

Poor WASH in schools create a lot of problems that consequently affect education or learning activities. Learning, healthy, and hygiene are interwoven. The stay of children or staff at schools is significant I its role to encourage spread of infection due to poor

WASH. Worms easily spread in children because they may be of little knowledge or practice of hygiene behaviors, they play together due to peer pressure, they touch objects and soil easily (Adeoye, 2001; Amhara National Regional State Health and education Bureau, 2010). Some demerits of poor WASH are summarized in Table 3.

Table 3: Typical examples of demerits due to poor WASH

Parameter	Specific cause	Effects (on education)
Poor WASH	Shortage or poor toilets	Spread of diseases, ill-health, poor growth, retardation, poor learning ability, hospitalization, absenteeism
Poor WASH	Shortage of pure water	Indignity, insecurity, bad odor, stink
Poor monitoring or supervision	Poor WASH	Spread of diseases, ill-health, poor growth, retardation, poor learning ability, hospitalization, absenteeism

Suggestions

The following suggestions are made in order to help in ensuring WASH parameters and services are improved in schools.

- Parents have the responsibility of following-off in order to see that WASH is maintained at schools for their wards to be healthy. Parents ought to attend meetings, engage with

stakeholders, and other parents for the purpose of providing clean water at schools. They can help pool funds and resources to provide water facilities and seek for policymakers interventions in the course of providing water to schools (CDC, 2018).

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- Provision of proper and sufficient hardware or infrastructures for water, sanitation, and hygiene at schools by authorities, parents, doors, communities, etc (Civiltà dell' Acqua International Center, 2012). Table 4 included the needed hardwares and relations that are to be provided in ensuring WASH in schools.

Table 4: Facilities or materials needed in providing WASH at schools

S/N	Parameter/ infrastructure	hardware/ hardware/	Description/ remarks
1			1 latrine for every 25 girls, 1 for female staff, 1 toilet for every 50 male students, 1 toilet for male staff. Latrine has to be equipped with walls, roof, good slabs, doors, curtains, ventilation, broom, cleaning material (water or related stuff such as tissue paper, leaves, etc). It is also required that light, security, cleaner and accessibility should be provided for each toilet.
2	Handwashing facilities	items or	To be placed in the toilet or nearby. There should be source of water, basin, soap or ash, bottles or kettles.
3	Drinking water		Safe drinking water should be provided, for instance, 5 liters for each student every day.

- Health education and awareness involving teaching the public or parents or stakeholders or policy makers on ways of maintaining hygiene and sanitation. Use of tips like “walk of shame” fecal

calculation, are advisable string tricks to incite people to act properly in this regard. Parents should be ignited to make sanitation commitment that assist WASH in schools (Abubakar & Raji, 2021).

- Teaching of children about good hygiene, WASH behaviors in and out

of classroom is a good tip to WASH in schools achievement. This should be in subjects such as mathematics,

biology, economics, geography, religion, and other at least once in every week

Merits of Water

The importance of water in public health nutrition cannot be overstated. Water plays a crucial role in ensuring the health and productivity of populations, and its applications are numerous. In domestic settings, water is used for food preparation, human and animal consumption, personal hygiene, and environmental hygiene. In agriculture, water is necessary for crop growth, livestock production, and irrigation. Industries also rely on water for food processing, preservation, and storage. However, water scarcity and contamination are significant concerns globally, particularly in developing nations. Impure water can lead to various health problems, including waterborne diseases such as cholera, diarrhea, and typhoid fever. Water pollution can also have detrimental effects on aquatic ecosystems and human health. To address these challenges, it is essential to prioritize water conservation, proper waste disposal, and sustainable water management practices. Ensuring access to safe and sufficient water is critical for promoting public health and nutrition. This can be achieved through the construction of wells and boreholes, improvement of water storage systems, and proper treatment of public water supply systems (Styrer, 1988; Stenesh, 1998).

Water also plays a vital role in human nutrition, making up approximately 55-75% of the human body. It is essential for hydration, digestion, and temperature regulation. Adequate water intake is necessary to prevent dehydration and maintain overall health (Santra, 2017).

Certainly, water is a vital component of public health nutrition, and its importance cannot be overstated. Ensuring access to safe and sufficient water is essential for promoting health, productivity, and well-being. By prioritizing water conservation and sustainable water management practices, we can help address the challenges of water scarcity and contamination, and promote a healthier and more sustainable future. Water is significantly important in ensuring that every population remain healthy and productive, consequently its applications are quite numerous (Styrer, 1988; Stenesh, 1998). The followings are basic applications of water as relates to public health nutrition:

- Domestic uses-Water is used at home and other related destinations such as schools for preparation of food materials, and human or animal consumption. Likewise, water is utilized at home for ensuring personal hygiene, environmental hygiene, and the likes
- Agricultural uses- In the family either for cultivation of fishes, plants or rearing of poultry; the great sources of healthy food pure and large quantities of water is needed or utilized. Plants utilized water in photosynthesis in order to make foods (carbohydrates or carbon skeletons) required by humans or animal to tap ATP for living. For instance, light energy struck chlorophyll to lyse the water (photolysis) which is later reconstructed and oxygen is liberated. Other dealings of the photosynthesis come-up after this.

- Industrial uses of water- Related to public health nutrition, water is used in industries to prepare foods, ensure hygienic food preparations, food preservation and storage and other related processes (Santra, 2017).

However, all uses or merits of water are as a result of some advantageous properties of water such as the followings underneath:

- Water as a great biological solvent - The molecule in water exist as irregular skewed tetrahedron with oxygen positioned in the center. The existence of two hydrogens, unshared electrons of the two remaining SP^3 -hybridized orbits dwell in the corner of the tetrahedron. There is 105° angle between hydrogens (atoms) that differ slightly from the 109.5° .
- Water molecule has strong dipole causing the presence of high dielectric constant, therewith, a dipole is a molecule having electric charge asymmetrically distributed.
- Water forms hydrogen bonds-A situation whereby, a partially unshielded hydrogen nucleus is covalently bonded to a given electron-withdrawing oxygen atom (or nitrogen) interact with an unshielded electron pair in another oxygen or nitrogen (atom) makes hydrogen bond. Water molecule forms hydrogen bond, whereby self-association is favored to make ordered arrays. The hydrogen bond forming capacity relates in the high viscosity, boiling point, surface tension, and similar features of water. The ability to dissolve many polar organic compounds in water is earned due to hydrogen bond. For instance,

alcohols, amides, ketones, aldehyde are hydrogen acceptors providers in their interaction with water.

- Water and biomolecules interaction- Mostly, biomolecules are amphipatic, having polar nature. Every member of these molecules fold in a way that water-loving entities are outward, while the water-hating groups are shielded, for instance proteins, and lipid bilayer (Styrer, 1988; Stenesh, 1998).

Implications of pure water scarcity

Every water has two properties, including quantity and quality. The water has to be pure and enough for each and every population to live healthy and progress. However, the two stemming issues affecting public water supply nowadays revolve round the fact that water is scarce and often impure (even if available). The issue of water supply and quality has been a concern of both developed and developing nations across the globe. Developing populations mostly faced too folds of challenges because their water supply is scarce and impure often (Inkani, 2015; Ibrahim & Patrick, 2017). Singh & Dey (2014) in a study of water quality in Manipur show that pollution due to solid waste lead to the conversion of water into an impure form. Raji et al.(2010) in Sokoto determined the levels of As, Pb, Cr, Ni, Se, Br, and all these metals were above the WHO recommendations. Galadima & Bisiriyu (2013) disclosed that there was high level of arsenic in well water in Sokoto State, Nigeria. Nura & Fada (2017) show that most of the sachet water in the Sokoto city contain unsafe microbes. However, issues on the water supply of the public arises because of certain factors such as environmental, economic, industrialization, corruption, poverty, etc.

Poor families or populations have no enough and good facilities to supply pure and sufficient water for public consumption. Environmental factors such as the living in desert, semi deserts, and marine areas, climate change, lead to poor water supply (quantitatively and qualitatively). Civilization factors such as pollution that involves seeping of refuse, sewage, oils, agricultural chemicals, and industrial by-products into the soil or groundwater or water bodies often lead to polluted or contained water (Santra, 2017).

Meanwhile, water scarcity or water contamination has been tied-up to various forms of toxicity or infection affecting human populations, because humans consume microbes or harmful chemicals through water. Organic matter in water cause low oxygen levels by affecting aquatic organisms such as fishes. Thermal pollution can increase organic matter decay or incite stress in the native organisms. Low or acidic pH brought about by pollutants cause injury to fresh water organisms such as plants, fishes, etc. Presence of excess metals in water cause detrimental effects on aquatic animals and human consumers as well, leading to consequences such as injury, cancer, oxidative stress or deaths (Santra, 2017; Jiya et al., 2020).

Moreover, polluted or impure water can contain microbial entities apart from chemicals, and consequently cause effects. Waterborne microbes or infections include, *Vibrio cholerae*, poliomyelitis, giardiasis, trichurias, typhoid fever, diarrhea, dysentery, shigellosis, amebiasis, hepatitis A, Adenoviruses, rotaviruses, *Salmonella*, *Taenia*, etc. Water Related diseases include, filariasis, malaria, river blindness, dengue fever, yellow fever, guinea worm, etc (Santra, 2017).

Consequently, in order to improve quality of water for public consumption and ensure that greater part of the population have access to healthy and sufficient water supply, the followings are suggested:

- Ensuring that people are enlightened about the important ways of preserving the environment in a sustainable fashion by adhering to proper waste disposal, and personal ways of keeping public water supply such as rivers, wells, lakes, etc relatively safeguarded against human recklessness of pollution
- Construction of more wells and boreholes in desert and semi deserts areas, along with irrigation systems that supply water to the public to adapt to climate change.
- Improvement in water storage systems especially during rainy season, in order to amend the effect of dry season periods.
- Ensuring that public water supply systems are treated properly. This required resources such as funds that should be pooled or allocated by the government (Sifawa & Muhammad, 2014; Reza & Yousof, 2016; Salihu et al., 2017).

Public Health Nutritional Role of Water

Water is vital for quenching thirst, losing about 10% of body's water may lead to severe weakness or heat stroke. A human biological system can thrive for weeks without consuming food, but the biological processes can health because of lack of water in the body (if the problem persist for few days). Water makes about 55% to 75% of the body (about 10 to 12 gallons) in most adults. Basically, water is a vital component of the body fluids such as blood, stomach fluid,

urine, gastric juices, saliva, and amniotic fluid. Lubrication of joints, moistening of eyes, mucous membrane is performed due to water. Water is essential for removal of waste products of metabolism in urine, sweat, and stool. Regulation of the body temperature is another important key role of the water in human body (Shehu et al., 2013; Rasul et al., 2021; Michigan WIC Program, 2022).

Despite the fact that, our body don't store extra water, everyday an adult lose about 10 cups of water (averagely) through urine, stool, sweat, respiration (breathing), and perspiration. Certain conditions aggravate water needs, such as breastfeeding, pregnancy, consumption of higher fiber diet, sicknesses, high temperature, exercise, etc. An adult has to take 8-12 cups daily (Michigan WIC Program, 2022). Failure to replace lost water in the body may lead to dehydration. Dehydration results in overheating of the body, weakness, dizziness, and headache. Severe case of dehydration lead to delirium, and death. However, children need 6 to 8 cups every day. Children and young people lose water through diarrhea, sweating, vomiting, and such may spur dehydration, reduced urine, sunken eyes, irritability, lethargy, and restlessness among others (Santra, 2017).

Types of Water

Water is a major common substance ever known. It is good solvent utilized to dissolve many substances, that is why it rarely occurs in pure form. There are several types of water including the followings:

Treated water - This water is a kind of water prepared for special purposes. Instances of treated water include chlorinated water, pipe borne water, distilled water.

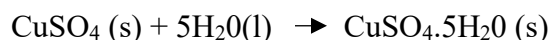
Distilled water is regarded as chemically pure, due to its preparation by condensing steam using Liebig condenser. Deionized water is prepared using exchange resin.

Township water- Pipe borne water that is treated and supplied for public consumption. The sources of this water may be originally from rivers, lakes, rainfall, etc (Wali et al., 2022).

Hard and soft water- Hard water is not capable of forming lather easily with soap as results of dissolved salts therein such as CaH_2SO_4 , MgH_2SO_4 , and CaCO_3 . Temporary hardness is easily neutralized by treating the water using boiling. Permanent hardness in water can only be removed using chemicals treatment. For instance, washing soda, zeolite, and caustic soda are used for removal of permanent hardness. Hard water tastes bitter, the calcium it contains may be utilized for nutritional basis, and hard water doesn't dissolve lead pipes. However, hard water is not good for washing, and sanitation, leading to waste of resources (such as soap) and is not good for industrial processes such as tanning and dyeing (Santra, 2017; Winter, et al., 2021; Wali et al., 2022).

Water and forms of Solutions

A solution is composed by dissolving a solid in a liquid, for instance, CuSO_4 in water, in order to make homogeneous mixture.



Water is a common universal solvent due to its polar nature. It dissolves substances such as mineral salts, bases, acids, and others. Others include covalent compounds having hydroxyl group, for instance alkanol, glycerol, sugars, etc. Mostly, all gases dissolved in water in a given extent, for instance, hydrogen chloride, ammonia, and carbon dioxide. Other gases such as hydrogen, nitrogen, and oxygen, dissolve

sparingly in water. Basically, solutions are advantageous for their applications in cleaning, laundry, manufacturing purposes, laboratory processes, personal hygiene, and performing chemical reactions in the biological systems (Styrer, 1988; Yahaya et al., 2019; Yarima et al., 2021).

Water cycle and sources

Water from the rain falls on the earth and reaches various parts of the world. Some of the water is evaporated to the atmosphere (water vapor), some are taken by plants (plants slowly release the water to the atmosphere by transpiration), some flows to reach the water bodies (such as rivers, streams) and in turn approaching the seas and oceans (Sridhar et al., 2020). The sources of fresh water for human consumption include the followings:

- **River-** Basically, rain falling contributes to sinking of some amount of water into the ground, and other process of making a river. River is made when the rainfall flows to form rivulets, tributaries, streams, brooks of rivers. Volume of river varies according to time of the season. Thus, when the volume (regime) is high it is good for storing or serving for public consumption or supply, farming, etc, and it may lead to flooding. Low river volume affects farming and public water supply. Nevertheless, river flow may result in transport of pollutants, and formation of solutions (Santra, 2017).
- **Ground water-**In the course of water cycle, the rain water seeps or sinks into the ground and it is described as ground water. Groundwater is utilized in many parts of the world as source of public water supply. The quantity

of ground water depends on climate, therewith, desert or semi deserts experience much evaporation, therefore, there may be low groundwater level. In humid areas, also the evaporation will be low, thus, most of the water move as runoff; while moderately humid areas runoff and sinking may be experienced. The nature of the rock in the soil also determine the level of ground water storage, when the water move in the ground it reaches an impermeable layer and stay. An outlet for the groundwater is known as spring, while a permeable rich where water is stored is known as aquifer, and the surface of the saturated area is known as water table (Santra, 2017).

- **Spring-Spring** is an underground water released out to the surface where the water table meet the surface. A spring is an outlet releasing water. Springs naturally occur as emergence of water points.
- **Well-A well** is a hole bored below the ground that reaches the water table and spurred the release of water. The water from the well is roved through manual or mechanical use.
- **Lakes-Lakes** are features of the earth surface that occupy hollows where water accumulates. Tiny lakes are as small as pools or ponds. Lakes may be temporary or permanent, but are due to rainfall or fed by rivers. Efforts (either natural or man-made) such as evaporation, runoff, season, percolation may cause the lake to dry off permanently or temporarily (Magami & Ibrahim, 2016; Kasarawa et al., 2017; Santra, 2017; Mustapha et al., 2022).

Conclusion

In summary, Water Sanitation and Hygiene (WASH) in schools is essential for promoting health, preventing diseases, and improving academic performance. Ensuring access to safe and sufficient water, basic sanitation facilities, and hygiene practices is crucial for creating a healthy learning environment. By

investing in WASH infrastructure, promoting health education, and engaging communities, schools can reduce the risk of waterborne diseases, improve student attendance and performance, and foster a healthier and more productive learning environment. Ultimately, prioritizing WASH in schools is vital for achieving better health, education, and socioeconomic outcomes.

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