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Operation and sustainability of Water, Sanitation and Hygiene (WASH) in schools: Evidence from a vulnerable and deprived area in Ghana

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Abstract: Safe and adequate water supply and sanitation in schools are pre-requisites for the right to basic education for school children and the achievement of goal 4 and 6 of the Sustainable Development Goals. Nonetheless, Water, Sanitation and Hygiene (WASH) in schools is fraught with inadequacy of toilet and handwashing facilities, and poor sustainability mechanisms that threaten its success. This paper, therefore, assesses the operation and sustainability of WASH in schools in the Nabdam District of Ghana. Adopting a qualitative approach, thirty-seven semi-structured interviews were held to capture the understanding and experiences of students, head teachers, health officers, officials of the Ghana Health Service and District Education Directorate on the phenomena. Fifteen focus group discussions were further held with students in the basic schools. The findings indicate that WASH is poorly managed even though the schools studied had some established WASH facilities. WASH in the schools was bedeviled with challenges such as inadequate toilets and handwashing facilities, poor funding and ineffective WASH committees. The WASH committees lacked the capacity to raise funds and carry out their duties in accordance with the WASH implementation guidelines. The study recommends that the Ghana Education Service organizes periodic capacity building programs for WASH committees to address this shortcoming. The Ministry of Education should support basic schools in districts in their efforts to provide WASH facilities and fund WASH activities. The study also calls for the formation of

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student WASH clubs and sanitation brigades to promote the operation and sustainability of WASH in schools.

Subjects: Development Studies; Health & Development; Sustainable Development; Middle School Education

Keywords: Water; Sanitation and Hygiene; WASH in schools; basic schools; Ghana; sustainability of WASH

1. Introduction

Access to Water, Sanitation and Hygiene (WASH) remains central to the Sustainable Development Goals (SDGs) where access to these services has been recognized as a human right (United Nations, 2010; United Nations, 2015). Goals 4 and 6 of the SDGs aim at ensuring a universal, sustainable and equitable access to safe and affordable drinking water, adequate sanitation and hygiene by 2030. The quest to prevent and reduce the effects of poor access to good quality facilities, led to the formulation and implementation of the WASH programme aimed at ensuring proper sanitary conditions (UNICEF and World Health Organization, 2016). The UNICEF Ghana & CDD-Ghana (2016) indicate that WASH is at the center of all efforts towards achieving goal 4 and 6 of the SDGs.

The United Nations Children's Fund (2009) emphasizes that the focus of the WASH programme is to push for investment in water-related programmes. The call to action for WASH in schools highlights key messages to secure commitment and mobilize action from governments and relevant stakeholders (UNICEF, 2010). The key messages include increased investment, policy engagement, stakeholder involvement, and demonstration of quality WASH in school projects. WASH in schools result in positive rippling effect; supporting general interventions directed towards the establishment of equitable access to potable water and sanitation services and providing a pathway to improve access to quality education and preventive health measures (UNICEF, 2010; United Nations Children's Fund, 2009). The primary goal of WASH is to improve child health and school performance by reducing the likelihood of children being infected with water and sanitation-related diseases (World Health Organization [WHO], 2009). Furthermore, it encourages children to demonstrate good hygiene practices to their families and community (UNICEF, 2012).

Related to the foregoing, schools are required to implement appropriate WASH initiatives to ensure safe and healthy environment that is clean and free of bacteria that cause infections such as diarrhea, cholera and dysentery. According to UNICEF (2015), more than 800 children die from diarrhea every day, which is directly linked to unsafe water, poor sanitation and unhygienic conditions. It is also worth noting that a growing number of deaths (about 85,700 per year), mostly among children under 15, are recorded from some preventable water-related diseases, poor hygiene and sanitation facilities (UNICEF, 2021). Improved water and sanitation, as well as handwashing, could reduce diarrhea cases by 52% (Darvesh et al., 2017; Wolf et al., 2022).

In Ghana, approximately 5,100 children die each year as a result of diarrhea, with 90% of these deaths being caused by poor WASH (The World Bank, 2012). The Ministry of Education in 2010 thus introduced WASH in the Education Strategic Plan (ESP 2010–2020) under the Quality Education (QE) policy objective to improve access to potable water and clean sanitation facilities (Ghana Education Service, 2014).The objective is to improve hygienic systems, access to adequate water and sanitation facilities in basic education. The policy aims to achieve 100% Basic Education School hygiene and sanitation by 2015, with 75% of schools having access to potable water (Ghana Education Service, 2014).

Empirical studies on WASH in schools have so far discussed sanitation practices (Gyabaah & Awuah, 2014), handwashing and hygiene practices (Monney et al., 2014; Steiner-Asiedu et al.,

2011), and the assessment of school-based hygiene facilities (Appiah-Brempong et al., 2018; Tiswin et al., 2019). However, literature on WASH in schools fails to present sustainability mechanisms for its continued operation, expressly in vulnerable and deprived areas. This study fills the gap by examining the operation and sustainability of WASH in schools in the northern part of Ghana [noted to be the most vulnerable and deprived area in terms of access to water and sanitation facilities]. The rationale of the study is as follows; (i) understanding WASH in Schools could inform the formulation of policy and/or programme that aims at promoting hygiene, and supporting national and local interventions to establish equitable, sustainable access to safe drinking water and basic sanitation services in schools, and (ii) the implementation of the results from this research may be important to contributing to the realization of goal 4 and 6 of the Sustainable Development Goals. Based on the research gap identified and the rationale, the objective of the study is to examine the operation and sustainability of WASH in schools in the Nabdam District of Ghana.

2. Materials and methods

2.1. Study setting

The Nabdam District, carved out of the then Talensi-Nabdam District, was established by Legislative Instrument (L.I) 2105 of 2012. Nangodi is the capital town of Nabdam District in Upper East Region (**see** Figure 1). The population of Nabdam District has been increasing rapidly with annual population growth rate of 4.62% between 2000 and 2010, which is higher than the growth rate (2.5%) of Ghana (Ghana Statistical Service, 2012). The Nabdam District has 77 public schools, which comprises 31 Kindergartens, 27 Primary and 19 Junior High schools.

According to UNICEF Ghana and CDD-Ghana 2016, the Nabdam District is one of the deprived Districts in Ghana, with poor sanitation and hygiene issues. In some cases, pupils, teachers, vendors and the community at large use sanitary facilities, such as water, toilet and refuse bins, at schools, thus putting pressure on them. Despite the aforementioned challenges confronting basic schools in the Nabdam District, there have been efforts to curb the poor sanitary conditions within the district. Private institutions, Non-Governmental Organizations (NGOs) as well as the Government of Ghana have made various strides in getting the needed facilities and policies underway to reduce the spread of diseases linked with insanitary conditions in most basic schools (BusinessGhana, 2010; World Vision International, 2014). Mention can be made of the interventions such as the WASH in schools' programme, which is aimed at ensuring proper sanitary conditions in educational institutions across the length and breadth of Ghana (Ministry of Education, 2012; UNICEF, 2012).

Contribution to education, water, sanitation and hygiene remain poor in schools within the district (Talensi District Assembly, 2014). Most schools have to cope with the insufficient toilet facilities, washing soap and bins and other sanitary facilities (Ghana Statistical Service, 2012). As a result, most schools resort to burning and burying of solid waste, as well as open defecation practice among students. Having received support through the WASH programme, the district was thus selected to understand the operation and sustainability of WASH in schools.

2.2. Research approach

The study adopted the case study research design to gather and analyze relevant primary data. The approach allowed for an in-depth account of the social phenomenon examined (Creswel, 2007). The underlying principles of "how" and "why" type of questions were taken into account and oriented toward having an empirical enquiry that investigates a contemporary phenomenon within its real-life context (Yin, 2014).

The study employed multi-stage sampling technique to identify the units of inquiry. The sampling frame for the study included all public basic schools duly registered with the District Education Office (DEO) and the District Education and Health Offices. The Nabdam District has

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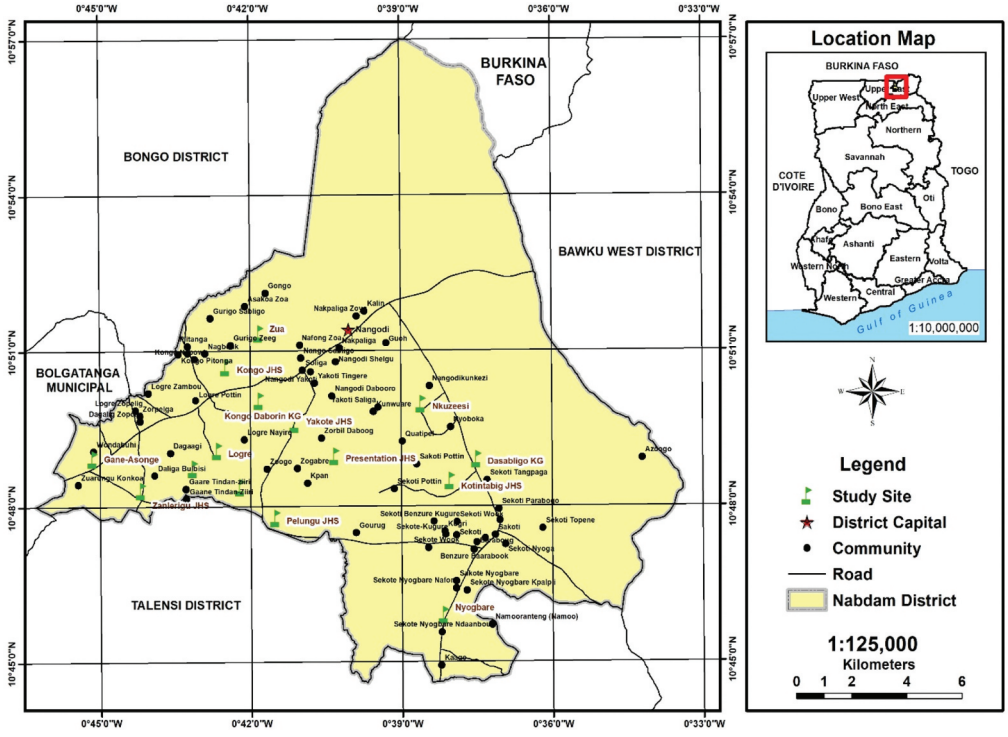

Figure 1. The map of the study area and the focused basic schools.

Source: Map drawn by Gabriel Mawuko, Department of Planning, Kwame Nkrumah University of Science and Technology

77 public schools, including 31 kindergartens, 27 primary and 19 Junior High Schools. The basic schools were a mix of kindergartens, primary schools, and junior high schools, with each level treated separately. The selection of levels of education was based on the management of WASH facilities, which is done at each level of basic school. First, the public basic schools were grouped according to the five educational circuits in the district. The circuits were Nangodi West, Nangodi East, Sekote, Zuliba South and Zuliba North. These strata were subdivided into KG, Primary and JHS. Three basic schools were randomly selected from each of the five circuits in the district. These schools were selected to reflect all levels of basic education; one school each for KG, Primary and JHS were selected. Hence, a total of 15 schools were selected for the study.

The simple random sampling technique was used in selecting the 15 schools. Thirty-seven semi-structured interviews were held to capture the understanding and experiences of students (15), head teachers (15), and food vendors (2) in the sampled schools, health officers (2), officials of the Ghana Health Service (2) and District Education Directorate (1) on the WASH in the schools. These actors were selected based on their involvement in the implementation of the WASH programme in schools in the district. The semi-structured interviews elicited data on two themes: (i) facilities available and their conditions and (ii) sustainability mechanisms in place to ensure a successful operation of the programme.

Fifteen Focus Group Discussions (FGDs) were additionally held with students [within the ages of 10–17], and were separated by sex in each of the selected schools. Students were selected by schoolteachers to be representatives of the entire student body in the schools. The average number of participants of the FGDs was nine (Hennink, 2014). Direct observation was further employed to complement the interview data. The observational checklist was used to guide observations on the availability and conditions of toilet and handwashing facilities, water taps, containers for drinking water and general sanitary conditions. Survey instruments were piloted in schools and revised before use in study collection. Informed written and verbal consent were sought from the participants before the start of data collection.

Semi-structured interview schedules, informal group discussion guides and school observation checklist were developed using UNICEF and WHO (2016), which present questions and indicators for monitoring WASH in schools. The questions and indicators focused on knowledge of WASH facilities, operational and non-operational toilet and handwashing facilities and their location. Sustainability mechanisms for the successful operation of WASH were assessed using questions related to funding, maintenance and challenges of the WASH programme.

The data collected were examined for completeness and accuracy. Data was analyzed using qualitative and quantitative techniques. Quantitative data were analyzed using SPSS (version 23) to create descriptive statistics. The content analysis was used to analyze the interview transcripts through an inductive and deductive coding process. This was facilitated by the use of NVIVO 10 software for coding the data and developing categories and sub-categories. This method of analysis aided in categorizing the data to make valid inferences. A mind map to summarize key points in WASH in schools was also developed. Primarily, factors are those that were frequently mentioned by participants or were mentioned as critical even though only one or two participants mentioned them. The arrows in the mind map represent the relationships or interconnections between factors mentioned. A factor, in this paper, refers to WASH in school elements such as funding, institutional setups, and so on, whereas dimension refers to Operation and Sustainability aspects of WASH in schools. The mind map has three main levels: (1) the center—WASH in schools in Nabdam District, (2) the two WASH dimensions, and (3) the key factors or elements related to the dimensions derived from the in-depth interviews. The mind map enables us to identify the "root causes" and "effect" of a problem, which are represented by a factor or element at the start of a relationship or an interconnection pathway.

3. Results and discussion

All findings were grouped and discussed within the scope of operation and sustainability of WASH in schools. The findings are followed by a discussion of a WASH mind map.

3.1. Assessment of WASH Facilities

Availability of WASH facilities in schools is a basic requirement for the implementation of the WASH programme. According to the UNICEF (2012), every school that seeks to successfully implement the WASH programme must first have gender-appropriate and adequate toilet and hand-washing facilities, access to potable drinking water and solid waste facilities with proper boundaries. The paper, therefore, assessed the WASH facilities available in the schools studied using UNICEF's standards for WASH in schools.

3.1.1. Availability and functionality of toilet facilities

The Ghana Education Service (2014) explains that elimination of open defecation, safe excreta disposal and toilet hygiene forms a core of WASH implementation in Ghanaian schools. Toilet facilities are expected to be adequate, hygienic and gender sensitive. Based on UNICEF (2012) standards for WASH in schools [one toilet per 25 girls and 1 toilet per 50 boys], the results show that all schools from the five circuits had inadequate facilities, with backlogs in the toilet facilities for both girls and boys (**see**, Table 1).

The required number of toilet facilities for boys in the five circuits was 51 compared to the 31 facilities available depicting a shortfall of 20 for boys in the public schools within the five circuits. A similar trend was observed with the females where an additional 14 facilities were needed to meet the required number of 39 toilet facilities for female pupils in the public schools. The shortfall in number of toilet facilities for both male and female pupils largely reflect the level of insanitary conditions in all the sampled public schools in the Nabdam District, which was confirmed during discussions with the head teachers. The head teachers revealed that there had been times were pupils had to resort to open defecation due to the inadequate number and pressure on the existing facilities. A study by Vivas et al. (2010) revealed that the appalling state of toilet facilities and sanitary facilities has implications for student's behavior. The absence of toilet facilities in schools

Table 1. Toilet facilities available and required in schools

Circuits	Available toilet facilities				Number of toilet facilities required				Shortfall			
	Boys	%	Girls	%	Boys	%	Girls	%	Boys	%	Girls	%
Nangodi West	11	35	9	36	15	29	10	26	4	20	1	7
Nangodi East	5	16	6	24	8	16	10	26	3	15	4	29
Sekote	4	13	2	8	10	20	6	15	6	30	4	29
Zuliba South	6	19	4	16	10	20	8	21	4	20	4	29
Zuliba North	5	16	4	16	8	16	5	13	3	15	1	7
Total	**31**	**100**	**25**	**100**	**51**	**100**	**39**	**100**	**20**	**100**	**14**	**100**

forces students to resort to solutions such as open defecation and plastic-bag defecation (Babalobi, 2013). According to Taulo et al. (2018), WASH programmes focusing on households can explain the current inadequacy of sanitary facilities in schools that show evidence of open defecation. Open defecation practices have however been argued to have enormous health and environmental implications (Ayalew et al., 2018; Mara, 2017; Saleem et al., 2019). Head teachers and students stressed that inadequate number of toilet facilities in schools had negatively affected the effective implementation of WASH in the schools studied:

> *"Both staff and students share a toilet facility. This has forced we the students to defecate in nearby bushes since we are uncomfortable to share the same toilet space with our teachers."* (A 16-year student, FGD)

One head teacher expressed dissatisfaction with the state of his school's toilet facility, explaining that is nearly impossible to keep it clean with over 200 students and staff using it.

> *"The toilet facility here is as bad as not having any. It is in good shape in the mornings after it has been cleaned. However, the situation changes two hours after some visits are made by students and even some staff members. The problem is with the excess pressure exerted on the facility" (A head teacher, Interview*).

An official of the District Education Directorate summarized the discussion on inadequacy of toilet facilities and poor sanitary conditions in schools:

> *"We have been well-informed that female students in the schools miss classes due to poor sanitary conditions in some schools within the district" (An official of the District Education Directorate, Interview*).

The finding suggests that inadequacies in school toilet facilities have resulted in the weak enforcement and implementation of WASH principles such as minimizing open defecation practices in and around schools and ensuring cleanliness of places of convenience. Furthermore, the district's inability to meet the toilet requirements has a negative impact on student participation in school. This has adverse implications on improved participation in education and performance (AusAID, 2012; Njau, 2016). A key requirement for effective WASH in Schools is the ability of schools to ensure the continuous operation of existing facilities through good maintenance practices (Appiah-Brempong et al., 2018; Gyabaah & Awuah, 2014; Monney et al., 2014; Steiner-Asiedu et al., 2011). The findings on the operational status of the toilet facilities in the schools revealed that each of the five circuits had at least one non-functional toilet facility. The Nangodi West and Zuliba South circuits had the most non-operational toilet facilities (see, Table 2).

Table 2. Operational and non-operational toilet facilities

Circuits	Total number of toilets available		Operational toilet facilities						Non-operational toilet facilities					
	Number of toilets	%	Boys	%	Girls	%	Total	%	Boys	%	Girls	%	Total	%
Nangodi West	20	36	8	35	9	43	17	37	3	38	0	0	3	25
Nangodi East	11	20	5	22	4	19	9	20	0	0	2	50	2	17
Sekote	6	11	3	13	1	5	4	9	1	12	1	25	2	17
Zuliba South	10	17	3	13	4	19	7	20	3	38	0	0	3	25
Zuliba North	9	16	4	17	3	14	7	15	1	12	1	25	2	17
Total	**56**	**100**	**23**	**100**	**21**	**100**	**44**	**100**	**8**	**100**	**4**	**100**	**12**	**100**

The primary reason for the non-operation of the toilet facilities was reported to be as a result of the poor state of the toilets, which was confirmed by the observations made during the survey. Many of the toilet facilities that were not in use had broken doors and windows, cracked slabs, and clogged toilet drop holes. These conditions were caused by prolonged use without proper maintenance.

A student lamented:

> *"The toilet in our school is not in use because of the bad state of the facility. The slabs are in a deplorable state and are dangerous for human use" (A 13-year-old student, Interview).*

A head teacher of a school concluded:

> *"The condition of the toilet facility is as a result of continuous and long use without any major renovations. This has led to the deterioration of the facility to the extent that it can no longer be used by students" (A head teacher, Interview*).

The implication is that in the coming years, there will be fewer usable toilet facilities and an increase in open defecation among students. United Nations (2015) argues that the functionality of toilet facilities in schools has a positive relationship with ensuring appropriate hygienic environment in and around school. The sustainability of WASH facilities in Schools is therefore critical for the continuous functionality and use by students to ensure hygienic environment.

3.1.2. Handwashing facilities

The United Nations Children's Fund (2009), World Health Organization (2009) and UNICEF (2012) report that handwashing facilities must be available at strategic locations such as near toilets and urinals to improve hygiene practices through proper hand washing. UNICEF and WHO (2018) further emphasize the importance of handwashing facilities to promote hygiene and as a criterion for monitoring WASH in schools. The findings revealed that handwashing facilities in the schools studied range from tippy taps, plastic with tap and silver plates with water (**see**, Figures 2 and 3). The findings of the number of facilities available in each school in the districts in comparison to the required number revealed that all schools fell short of the required number of handwashing facilities (**see**, Table 3).

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Figure 2. Tippy tap handwashing facility.

The analysis of the required number of handwashing facilities revealed that 58 and 49 are required for boys and girls, respectively. However, at the time of this study, 41 and 37 handwashing facilities were available, implying a 29% and 32% deficit for boys and girls, respectively. A comparative analysis revealed that Nangodi West had the highest shortfall of five handwashing facilities for boys, while Zuliba North had the lowest shortfall of two handwashing facilities for boys.

Sekote, on the other hand, had the highest shortfall of three handwashing facilities for girls, while Zuliba North had no shortfalls. The unavailability of handwashing facilities in some schools in the district was found to contribute to the spread of diseases such as cholera.

An official of the District Education Directorate had this to say:

> *"There are about three or four schools in this district that do not have any handwashing facility. Those schools are usually prone to the spread of disease such as cholera, diarrhea etc."* (An official of the District Education Directorate, Interview).

This implies that the shortfalls in handwashing facilities affected the successful operation of WASH in schools initiative in the Nabdam district. This is a setback in health and education of students (Bowen et al., 2007; IRC, 2007; UNICEF, 2010). The outcome of the study is consistent with UNICEF and WHO (2018), who report that only 53% of schools have handwashing facilities in the world.

3.1.3. Operational and non-operational handwashing facilities

The findings revealed that approximately 28% (representing 22 in absolute terms) of the facilities were not operational (see, Table 4). About 41% of the non-operational facilities were located in Nangodi East circuit while Zuliba North recorded none. The reasons provided for the non-operation of these facilities include the intermittent flow of water and broken-down facilities. These views suggest that student face difficulty in keeping their hands clean and free from filth, which could

Figure 3. Plastic with tap and silver bowl with water handwashing facility.

Table 3. Handwashing facilities available and required in schools

Circuits	Number of handwashing facilities available				Number of handwashing facilities required				Shortfall			
	Boys	%	Girls	%	Boys	%	Girls	%	Boys	%	Girls	%
Nangodi West	10	24	6	16	15	26	10	20	5	29	4	33
Nangodi East	11	27	7	19	15	26	10	20	4	24	3	25
Sekote	7	17	11	30	10	17	12	25	3	18	1	8
Zuliba South	5	12	7	19	8	14	10	20	3	18	3	25
Zuliba North	8	20	6	16	10	17	7	14	2	12	1	8
Total	**41**	**100**	**37**	**100**	**58**	**100**	**49**	**100**	**17**	**100**	**12**	**100**

contribute to the spread of infectious diseases. Other studies have reported similar findings of handwashing facilities in schools being non-operational due to intermittent water flow and broken-down facilities (Appiah-Brempong et al., 2018); (Dube & January, 2012; Mwachiro, 2014). Evidence suggest that handwashing among students prevent infectious diseases (diarrheal and respiratory diseases) and reduce school absenteeism (Bowen et al., 2007; IRC, 2007; UNICEF, 2010). A lack thereof does not bode well for sanitation and hygiene in schools.

3.1.4. Categories of handwashing facilities

UNICEF (2012) recommends that students wash their hands with soap before meals and after using the toilets and urinals. A handwashing facility is defined as "a device designed to contain, transport or regulate the flow of water in order to facilitate handwashing" (UNICEF and WHO, 2018). Within this broad definition, handwashing facilities of various types (sink with tap water, bucket with taps, tippy-taps, pitcher of water and a basin) are available (UNICEF and WHO, 2018; World Health Organization, 2009). It emerged from the study that tippy taps, plastic containers with taps, silver containers without taps, and bucket and water were the handwashing facilities used in schools (see, Table 5).

Tippy-taps were identified as the most common type of handwashing facility (38.5%). This finding is in line with Tiswin et al. (2019), where tippy-taps and buckets with taps fitted were found to be the most common handwashing facilities in schools in Zabzagu. The dominance of this type of handwashing facility can be attributed to the ease of design and appropriateness. Bucket with a cup was the next used facility because of its ease of acquisition (26.5%). Tippy-taps, plastic containers with taps, and buckets with cups are considered good hand-washing facilities (UNICEF and WHO, 2018; World Health Organization, 2009) because they provide a running source of water and are always covered. Approximately 10% of the handwashing facilities were silver container without a tap. The main shortcoming of the silver container without a tap is the stagnant nature of the water used for handwashing. This promotes the growth of microorganisms, which can be transferred to the hands during washing. The use of silver containers without taps in schools should be discouraged (UNICEF and WHO, 2018; World Health Organization, 2009).

3.1.5. Location of WASH facilities

One of the most important requirements for the operation of WASH is that facilities (toilets and handwashing) should be within reasonable distance to encourage convenient use. For instance, a toilet facility is expected to be within 30 meters reach of all users and should be secure, hygienic and have handwashing facility close by (UNICEF, 2012). Water points should also be placed in strategic locations such as kitchens and toilets, and they should be accessible to both staff and students.

Table 4. Operational and non-operational handwashing facilities

Circuits	Handwashing facilities available		Operational Handwashing facilities						Non-operational Handwashing Facilities					
	Number	%	Boys	%	Girls	%	Total	%	Boys	%	Girls	%	Total	%
Nangodi West	16	21	5	18	5	19	10	18	5	36	1	13	6	27
Nangodi East	18	24	4	15	5	19	9	16	7	50	2	25	9	41
Sekote	18	21	6	22	8	22	14	25	1	7	3	37	4	18
Zuliba South	12	16	4	15	5	19	9	16	1	7	2	25	3	14
Zuliba North	14	18	8	30	6	21	14	25	0	0	0	0	0	0
Total	**78**	**100**	**27**	**100**	**29**	**100**	**56**	**100**	**14**	**100**	**8**	**100**	**22**	**100**

It was discovered that 39.2% of the toilets were located outside school compound. Out of this total, 32.1% were located near the school, with the remaining 7.1% far within the community (see, Table 6). On average, toilet facilities in the community were 400 metres away from the school facilities. These are communal toilet facilities that are characterized by poor maintenance and lack of handwashing facilities. A head teacher at one of the schools that use a communal toilet facility described students struggle to use the facility.

> *"Students walk for about 400 metres to access the toilet facility. Besides the long distance, the facility is in a deplorable condition. There are no handwashing facilities and the maintenance is poor. When we make our students clean them, it does not last two hours before it gets dirty again. Most students resort to defecating in the nearby bushes." (A head teacher, Interview).*

This implies that the toilet facilities in the community did not meet WASH standards (UNICEF, 2012). Toilet facilities were relatively close to school compounds, with an average distance of 100 metres. Even though these were greater than the recommended distance of 30 metres, the study revealed that the location of these facilities was determined by the availability of appropriate land space to site toilets within school compounds. As a result, these toilet facilities were solely used and maintained by the schools. The study found that all available handwashing facilities were located either near toilet facilities, kitchens, or classrooms, or at multiple locations. The placement of these facilities encourages students to wash their hands.

Table 5. Categories of handwashing facilities

Circuits	Tippy Taps	Bucket with a cup	Plastic container with a tap	Silver container without a tap	Total	Percentage
Nangodi West	21	15	16	4	56	28.0
Nangodi East	19	15	11	3	48	24.0
Sekote	20	7	4	4	35	12.5
Zuliba South	10	10	15	6	41	20.5
Zuliba North	7	6	4	3	20	10.0
Total	**77**	**53**	**50**	**20**	**200**	**100.0**

Table 6. Location of toilet facilities in basic schools

Circuit / Location of facility	Nangodi West	Nangodi East	Sekote	Zuliba South	Zuliba North	Total	Percentage
Inside the school	12	7	4	6	5	34	60.8
Near the school	5	3	2	4	4	18	32.1
Within the community	3	1	0	0	0	4	7.1
Total	20	11	6	10	9	56	100.0

3.1.6. Water supply facilities

Water for drinking, cooking, and cleaning is expected to be of adequate quality and quantity, with water points strategically placed to ensure access by all (Appiah-Brempong et al., 2018; Monney et al., 2014; UNICEF, 2012). The study examined the various sources of water for schools and their compliance with UNICEF (2012) standards. The study found that the major sources of water in schools were borehole fitted with pump, mechanized borehole and a well fitted with pump (see, Table 7). Borehole fitted with pumps were the most common source of water for schools, accounting for approximately 51% of the water supply facilities. These sources of water are all considered potable, and thus safe for drinking, washing, and other domestic and commercial activities (Community Water and Sanitation Agency, 2010).

The study used the frequency of flow and the waiting time at water points to access water to assess the adequacy of water facilities for schools. The study revealed that only 3.5% of the water sources did not flow at all times, requiring students, cooks, and other water users to travel to water points within their host communities to obtain water. The average waiting time at water points was seven minutes across all schools. Responses from students during focus group discussions confirmed these findings.

> *"Access to water is generally good in our school. We spend between one- and three-minutes fetching a bucket of water at the borehole. The borehole also flows at all times." (A 14-year student, FGD)*

The findings indicate that, with the exception of a few schools where water points have broken down and are no longer operational, access to water is not a major challenge in schools in the Nabdam District. Access to water in schools has positive implications for the use and maintenance of toilet and handwashing facilities. According to Antwi-Agyei et al. (2017), access to water in schools enhance the maintenance of toilet facilities and play a crucial role in positively impacting the health and education of students. A lack of water or rationing of water, thereof affects the use and maintenance of facilities (Dube & January, 2012). It is prudent, therefore, to ensure that schools have access to water to realize the goal of WASH.

3.1.7. Handwashing practices among school children

According to UNICEF (2012) and UNICEF Ghana & CDD-Ghana (2016), handwashing with soap at critical points reduces the likelihood of diarrheal disease by 48% and drastically decreases the chance of acute respiratory diseases. As a result, children are expected to wash their hands with soap before and after meals, as well as after using the toilet/urinal. Studies have shown that most schools either do not have handwashing facilities or do not have soap for handwashing (Appiah-Brempong et al., 2018; Jordanova et al., 2015; Mwachiro, 2014; UNICEF and WHO, 2018). As a result, the study looked into whether or not students in the Nabdam District washed their hands.

Table 7. Water supply facilities in basic schools according to circuits

Main Source of water	Circuits and number of water points						
	Nangodi West	Nangodi East	Sekote	Zuliba South	Zuliba North	Total	%
Borehole fitted with pump	8	8	7	9	7	39	50.6
Mechanized borehole	4	2	2	3	3	14	18.2
Well fitted with hand pump	3	8	6	4	3	24	31.2
Total	**15**	**18**	**15**	**16**	**13**	**77**	**100**

The study found mixed results regarding student handwashing behaviour. All pupils wash their hands before and after meals, however, they do not always wash their hands after using the toilet, urinal or during breaks. Students revealed that handwashing during breaks and after using the urinal was low because they believed that these activities pose no health risk. Same reasons were given for the low use of soap for handwashing during breaks and after visiting the urinal. Unavailability of soaps was also cited for the low use of soaps during handwashing.

> *"I wash my hands before and after meals and also after visiting the toilet. This is because these activities involve contact with the hands hence the need to wash them in order to avoid infections" (A 12-year-old student, Interview).*

> *"My school has no regular access to soap for handwashing hence students resort to washing hands without soap" (A head teacher, Interview).*

Students appear to have a limited understanding of the health risks posed by not washing hands after using the urinal and during breaks. Some students, for instance, did not wash their hands during breaks or after urinating because they were unaware of the health risks associated with these activities. This is consistent with the findings of Dube and January (2012), who found that primary school children had little knowledge of the diseases they could become infected with if they did not wash their hands properly. The finding calls into question the effectiveness of the health education component of the WASH programme in the Nabdam District. Dube and January (2012) argue that education based on school's curriculum is critical for knowledge on handwashing. UNICEF and WHO (2018) also recommend group handwashing at crucial times, provision of guidance and materials, and accessibility of handwashing facilities at all times to improve handwashing practices among students. The finding about the unavailability of soap is not surprising given that UNICEF and WHO (2018) found that 11% of schools worldwide have handwashing facilities but no soaps. This is not different from Mwachiro (2014) where one of the reasons facing the uptake of handwashing among students in schools was due to unavailability of soap in schools. This implies that, in addition to behavioral factors such as the belief that handwashing with soap is not necessary at certain times, the unavailability of soap also negatively affects hand washing in schools.

3.2. Sustainability mechanisms for WASH in basic schools

This section examines the sustainability mechanisms in place to ensure the successful implementation and operation of WASH programme in schools. These systems include both institutional setups and funding procedures for WASH implementation.

3.2.1. Funding for WASH in schools

The operation and maintenance of WASH facilities in schools are critical to the sustainable and hygienic use (Ghana Education Service, 2014). The establishment, operation and maintenance of WASH facilities requires funding to ensure their sustainability (UNICEF, 2012; Van Maanen et al.,

Table 8. Funding sources for WASH facilities

Funding sources	Circuits (percentages)					
	Nangodi West	Nangodi East	Sekote	Zuliba South	Zuliba North	Total (%)
PTA Contribution	55	47	57	42	35	46.7
Non- Governmental Organization	15	19	10	0	5	10.7
Government Contribution	23	30	29	49	50	35.8
Other sources (Fund raising and private donations)	7	4	4	9	10	6.7
Total	**100**	**100**	**100**	**100**	**100**	**100**

2016). Possible sources for funding include donations received from both individuals and organizations, budget on school maintenance, village or School Management Committee contributions or contributions from parents or teachers (Ghana Education Service, 2014; UNICEF, 2012). The findings of the study revealed that contributions from Parent Teacher Association (PTA), Non-Governmental Organisations (NGOs), income from fund raising activities and government contribution were the main sources of funding for WASH in schools in the Nabdam District.

The Parent Teacher Association (PTA) emerged as the largest contributor (with a proportion of 46.7%) in funding WASH facilities across all circuits in the district (see, Table 8). PTA contributions were in the form of annual dues from members and special contributions towards specific projects. Government contribution was the second largest contributor (35.8%). Government contribution were in the form of provision of WASH facilities such as boreholes, toilets and handwashing facilities. NGOs such as World Vision Ghana was mentioned as a key provider of WASH facilities (with a funding proportion of 10.7%) in schools in the district.

However, inadequate funding was identified as a barrier to the operation of WASH in schools. Interviews with head teachers revealed that some schools often were short of soap for handwashing at all times, faced with inadequacy of toilet facilities and irregular water for use within school compounds. It also emerged that the primary funding sources (Government and PTA) were not available to fund the operation and maintenance of WASH. Given the high poverty among people in the district, parents are some times over burdened and could not contribute effectively to funding WASH. The inadequacy of funding for operation and maintenance of WASH in schools has implication for the sustainability of the programme since provisions cannot be made for all requirements (soap and cleaning materials).

3.2.2. Institutional setups for WASH in schools

Aside from funding, schools provide services to ensure the successful implementation of WASH activities. The findings of the study revealed that schools were involved in hygiene education and training [in collaboration with other institutions], and establishment of WASH committees.

- Hygiene education and training

One of the main requirements of the WASH programme is that schools work to develop appropriate hygiene knowledge, attitudes, and skills through child participation and education (UNICEF, 2012). The findings of the study revealed that schools were engaged in hygiene education for school children to ensure a clean and healthy environment. It emerged from the study that hygiene education was often given by health officials to school children. Teachers also offered hygiene education during student assembly sessions and regular class hours. The hygiene education covered topics such as the proper use and maintenance of WASH facilities and disease

transmission control. Training sessions for teachers were also organized to provide them with the necessary knowledge in hygiene education.

> *"There are continuous efforts to ensure hygiene education among students in schools. This involves organizing health and hygiene education programmes for students and cooks (food vendors) by health officials. We also provide trainingto teachers to help them impart knowledge to students." (An official of the Ghana Health Service, Interview)*

The provision of hygiene education by the Ghana Health Service to school teachers, students and food vendors is critical to ensuring hygiene in schools. The students learn how to protect themselves from infectious diseases while also educating their families. The process encourages the development of healthy behaviours for life among students (UNICEF, 2012). Khatoon et al. (2017) assert that hygiene education in schools improves personal hygiene among students. The findings on the education of food vendors in this study is consistent with Dajaan et al. (2018). The education of food vendors has positive implication for adhering to food safety practices (Monney et al., 2014).

4. WASH Committees in basic schools

The USAID (2010) recommends the establishment of WASH committees in schools to ensure the sustainability of WASH projects. The import of the WASH committee is to assist in the overall running of the WASH programme. The WASH committee, among other things, is responsible for the maintenance of facilities, mobilization of funds and human resources for the provision of facilities, and organizing hygiene and health education.

The study found that there were WASH committees in all basic schools in the study district. About 66% (representing 51 out of 77 basic schools) of basic schools had substantive WASH committees while 34% had WASH subcommittees within their PTA (see, Table 9). The availability of the WASH committees, as explained by some head teachers, was in accordance with the requirements of WASH in schools.

> *"WASH committees are an integral part of the WASH programme. We were asked to ensure that these committees are in place to facilitate the effective implementation of the programme." (A head teacher, Interview).*

Another head teacher also shared a similar view:

> *"Every basic school is expected to constitute a WASH committee. It is a requirement of the programme, and we as a school have complied to that." (A head teacher, Interview).*

The study further investigated the activities of WASH committees to determine their compliance with expected roles. The committees were responsible for facility maintenance, hygiene education, environmental education, and the mobilization of funds for the provision and maintenance of

Table 9. WASH committee in schools

Circuit / WASH Committee	Nangodi West	Nangodi East	Sekote	Zuliba South	Zuliba North	Total	Percentage
Substantive WASH committee available	10	13	11	9	8	51	66.0
WASH committee as an arm of the PTA	5	5	4	7	5	26	34.0
Total	**15**	**18**	**15**	**16**	**13**	**77**	**100.0**

WASH facilities. This implies that all schools will have operational WASH facilities as the WASH committee ensures that there is soap availability and organize the repairs and maintenance of WASH facilities (USAID, 2010).

However, the majority of WASH committees were inactive or ineffective. For instance, only five WASH committees from the 15 schools studied had carried out maintenance activities in the past 12 months preceding the study. Similarly, four of the WASH committees were working to raise funds for WASH activities in schools. In the past 12 months preceding this study, two committees had organized hygiene education programs, and five had organized at least one hygiene education session since their inception. None of the committees collaborated with the community WASH committees on the implementation of WASH initiatives.

The reasons for their ineffectiveness ranged from a lack of technical expertise in financial mobilization and health and hygiene education to weak institutional structures.

> *"The major challenge confronting the committees is their inability to write winnable proposals and convince funding agencies and individuals to support the implementation of WASH" (An official from Ghana Education Service, Interview).*

> *"To be honest with you, the committees are not working. They do not even know what their roles are and sometimes the PTA performs their functions" (A head teacher, Interview).*

5. The WASH mind map

All the findings were summarized in the mind map shown in Figure 4, illustrating the interconnections between the factors for the operation and sustainability of WASH in Schools in the Nabdam District. The factors were clustered into two themes. The mind map shows how and what factors contribute to a specific theme. The mind map shows that WASH services in schools had "root causes" and "effects" i.e., the beginning and end of a relationship.

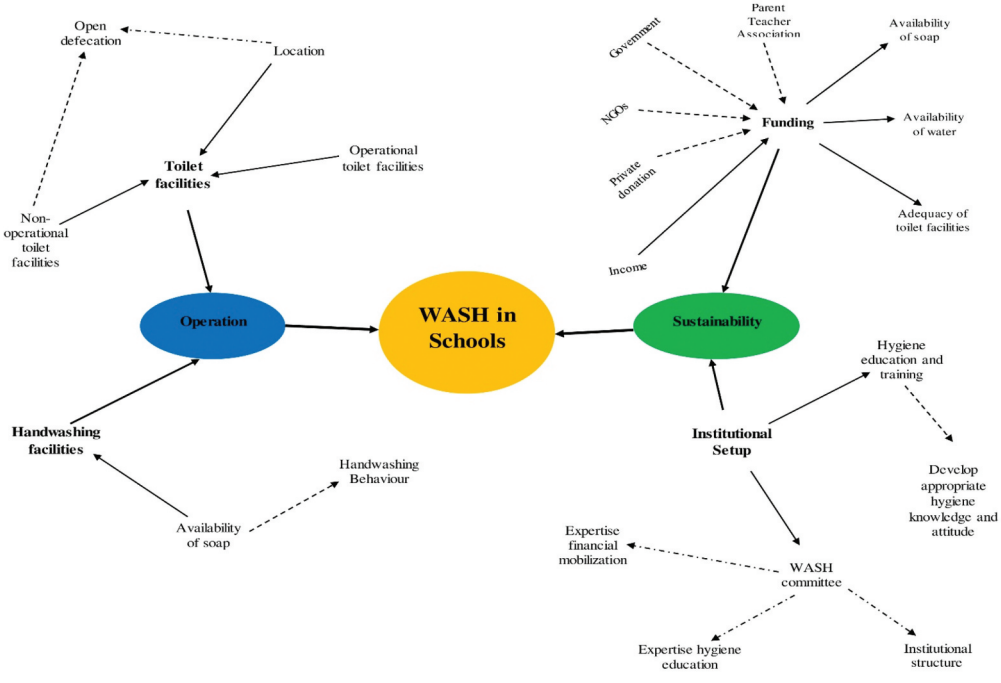

Figure 4. A mind map of factors contributing to the operation and sustainability of WASH in schools in Nabdam District.

The two discussion topics on the operation dimension of WASH in schools were toilet and handwashing facilities. Toilet facilities in schools were either operation or non-operational. The location and operationality of toilet facilities influenced its use. Schools with non-operation toilets and toilet located farther away pushed students to resort to open defecation. Handwashing facilities although not a problem in schools was affected by the availability of soaps. The unavailability of soap has the tendency of affecting handwashing behaviour among students.

In the sustainability dimension, funding and institutional setup were the two factors reported to be most important in contributing to WASH services in school. All funding sources for WASH programs were included in the map. Income [the area is noted to have a high poverty rate] was mentioned to contribute to funding WASH in schools in the study. Funding was found to affect the availability of soap and water, and adequacy and maintenance of toilets. Hygiene education and training, and WASH committee were identified as institutional setup factors that contributed to the sustainability dimension of WASH services. Good institutional setup would also result in sustainability of WASH in schools by effectively changing student behaviour and maintaining WASH services. Hygiene education and training in schools was to develop appropriate hygiene knowledge, attitudes, and skills among students and teachers. WASH committees were found to have low expertise in financial mobilization and hygiene education, and had weak institutional structures.

6. Recommendations

The study recommends that the Ghana Education Service organize capacity building programmes for WASH committees in schools. These programmes should focus on orienting committees about their roles, proposal writing and fund mobilization, health and hygiene promotion, among others. Also, the Ministry of Education and Ghana Education Service should through an educational policy instrument make WASH a compulsory subject in basic school curriculum. This will allow for capacity building for both staff and students in the operation and sustainability of WASH. The study also recommends the formation of student WASH clubs and sanitation brigades to help with the successful operation and sustainability of WASH in schools. Student WASH clubs and sanitation brigades should prioritize student health, with a particular emphasis on WASH. Finally, the Ministry of Education should support basic schools in deprived districts in their efforts to provide WASH facilities, fund WASH activities, as well as WASH committees to negotiate funding agreements with private sector organizations (such as NGOs and private businesses).

7. Limitation

The study has a limitation of focusing on Nabdam District in Ghana; therefore, it is unclear the extent to which the findings could be generalized to other settings. Also, the study was unable to perform an analysis on WASH interventions in schools and their influence on school performance. Additional rigorous study is required to comprehensively discuss this association.

8. Conclusion

WASH in schools has received global attention to inculcate healthy behaviors in students, prevent infectious diseases, and improve access to water and sanitation. Given the importance of WASH in education, this paper set out to assess the operation and sustainability of WASH in schools in Nabdam District [a vulnerable and deprived area] in Ghana. The findings indicate that the WASH programme was being implemented in all basic schools studied. Basic schools in the Nabdam district had toilet and handwashing facilities and access to potable water. However, with the exception of potable drinking water, toilet and handwashing facilities were inadequate. Even though schools had functional WASH facilities and institutional setups for the operation and sustainability of WASH, it was beset with several challenges. Some of these issues include inadequate WASH facilities (such as toilets and handwashing facilities), poor funding and ineffective WASH committees. Specifically, funding emerged as a challenge for WASH implementation because available funding sources were unreliable. The study has implication for national WASH policy and financing of WASH interventions in Ghana and other countries in sub-Saharan Africa.

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Data analyzed in this study are available from the corresponding author upon reasonable request.

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