EFFECT OF WATER, SANITATION AND HYGIENE FACILITIES ON HEALTH, REGULARITY IN ATTENDANCE AND EDUCATIONAL ACHIEVEMENT AMONG BASIC SCHOOL STUDENTS

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A Dissertation in Partial Fulfillment of the Requirements for the Doctor of Philosophy in Health Education

Submitted to

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Declaration

I hereby declare that this dissertation of degree of Doctor of Philosophy in Health Education entitled "**Effect of Water, Sanitation and Hygiene Facilities on Health, Regularity in Attendance and Educational Achievement among Basic School Students"** is my original work, and it has not been submitted for candidature in any other degree.

I understand that my dissertation will become a part of the permanent collection of Tribhuvan University library. My signature below authorizes my dissertation to any readers upon request.

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Mohan Kumar Sharma

February 17, 2023

Recommendation Letter

I, undersigned certify that I have supervised, approved, and recommended to the Graduate School of Education (GSE), Faculty of Education (FoE) for the external evaluation, a dissertation entitled "**Effect of Water, Sanitation and Hygiene Facilities on Health, Regularity in Attendance and Educational Achievement among Basic School Students"** submitted by Mohan Kumar Sharma in partial fulfillment of requirements for the degree of Doctor of Philosophy in Health Education.

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Approval Letter

We certify that we have approved the dissertation entitled "**Effect of Water, Sanitation and Hygiene Facilities on Health, Regularity in Attendance and Educational Achievement among Basic School Students"** presented by Mr. **Mohan Kumar Sharma** to the Graduate School of Education (GSE), Faculty of Education (FoE) for the degree of Doctor of Philosophy in Health Education.

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Abstract

This research assesses the effect of the availability of Water, Sanitation, and Hygiene (WASH) facilities in schools on health, regularity in attendance, and educational achievement among basic school students in Nepal. The overarching objective of this research is to assess whether combining WASH facilities in schools affects the health, school attendance, and educational achievements of students.

It applies a pragmatic paradigm, 'QUAN+qual' mixed methods, and a causal-comparative research design. The research was carried out among 800 respondents, split between 400 in the improved group and 400 in the unimproved group. Among them, 768 respondents participated in the quantitative and 32 in the qualitative study. Overall, school WASH facilities, including attitude, subjective-norms, self-efficacy, and intention, were found to have a statistically significant on students' health, school attendance, and educational achievements ($p<0.001$). Students with improved school WASH facilities are less likely to have sick (cOR=0.388; 95% CI; 0.290-0.519, $p<0.001$), more likely to attend school (cOR=2.802; 95% CI; 2.033-3.862, $p<0.001$), and more likely to achieve higher educational achievements (cOR=2.769; 95% CI; 2.062-3.720, $p<0.001$) than those without access to improved school WASH facilities. Furthermore, students who have good health status are more likely to be regular (cOR=3.160, 95%, CI; 2.585-5.042, $p<0.001$), and regular students are more likely to get higher educational achievements (cOR=0.641, 95% CI; 0.472-0.872, $p<0.01$) compared to students with poor health and irregular, respectively.

Although school WASH facilities have a statistically significant and predictors on students' health, attendance, and educational achievements, methods of managing these facilities are just as important as their availability.

CHAPTER I

Introduction

This chapter is divided into eight different sections. It includes the background of the study, statement of the problem, the rationale of the study, objectives of the study, research hypothesis, delimitations of the study, operational definition of the key terms, and the organization of the dissertation.

Background of the Study

Nepal envisions that every citizen shall have the right of access to a school education. The constitution of Nepal 2015, for the first time under Article 31, advocated for free and compulsory education, according to the Ministry of Education (MoE, 2019). The provision imposes an obligation on the state to ensure free education up to the secondary level and compulsory and free basic education. The terms basic education and secondary education have been defined under the definition clauses of the Act, 2018. As per the Act's mandate, 'Basic Education' means school education up to eight grades from class one, whereas 'Secondary Education' means school education between classes nine to twelve, according to the School Sector Development Plan (SSDP) (SSDP, 2016). Briefly, since the implementation of the School Sector Reform Plan (SSRP, 2009/10-2016/17) and with the continuation of the current SSDP (SSDP, 2016/17-2020/2021), the school education system has been presented as Basic Education (Grades 1-8) including Early Childhood Education and Development/Pre-Primary Education (ECED/PPE) and Secondary Education consisting of grades 9-12.

To date, there are altogether 35,055 community and private schools established where total 72, 14, 525 students are studying in basic and secondary levels across the country (GoN, 2019). Furthermore, GoN Flash-I Report 2076 (2019-2020)

highlights that the promotion rate to the lower basic level (1-5) is 90%, with 89.4% for boys and 90.7% for girls. The dropout rate is 3.6%; 4.1% for boys and 3.3% for girls. It shows a slight lower promotion and a slightly higher dropout rate of boys compared to girls. Likewise, in the basic upper level (6-8), the promotion and dropout rates are (92.5%) and (3.8%), respectively. A slight difference is noted; boys have a 91.9% promotion rate, compared to 93.1% for girls. Similarly, boys have higher dropout rates (4.1%) compared to girls (3.3%). Thus, girls have a higher promotion rate and lower dropout rate in the basic upper level than boys (MoE, 2019).

Community schools across the country lack adequate WASH services. More importantly, among a total of 33,160 community schools, only 79% of schools have toilets, and only 36% have separate toilets for girls (JMP, 2018). Significantly, Shrestha et al. (2017) presented that almost no schools' toilets met the students' toilet standard set. The National Sanitation and Hygiene Master Plan (NSHMP) (2011) and National Framework of Child-Friendly School for Quality Education (NFCSQE) (2010) mandated separate toilets for boys and girls. The report recommends an equal proportion of toilets (50) each sex, as well as separate toilets for disabled students. It also includes separate toilets, urination, and defecation facilities for male and female staff with running water and a regular cleaning management of these facilities that includes handwashing facilities as well. The doors and windows of toilets must be able to be bolted from inside, and an incinerator and a new septic tank are included as minimum indicators of the WASH facilities with which schools should be equipped. Furthermore, the NFCFSQE (2010) stated that the availability of a tap with potable water within school premises is a minimum indicator and provision of drinking water with a filter in every school classroom is a basic need. Besides these, a separate

Menstruation Hygiene Management (MHM) room with MHM materials, handwashing materials, and running water is expected.

The GoN has made considerable efforts to improve the water supply and sanitation in the country by formulating and enforcing several WASH policies, guidelines, and acts for the last two decades (Budhathoki, 2019). However, the situation has not improved as much as expected.

WASH is a fundamental requirement for the development and well-being of children at schools. Adequate water supply, inclusive sanitation, and good hygiene practices in schools can reduce the cases of hygiene-related disease; increase students' attendance and learning achievement; and contribute to dignity, inclusion, and equity. Therefore, the school should be designed to sustainably improve access to safe and sufficient water, adequate and inclusive sanitation facilities, and promote good hygiene practices to enhance the learning environment and educational performance. Works of literature, for example, Postlethaite (1998) showed that schools in Low-Income Countries (LIC) often include conditions not conducive to learning. The poor WASH conditions are contributors to this problem. The United Nations Children Funds (UNICEF) (2010) stated that WASH access at school is a critical element of a healthy environment to mitigate disease burden. The World Health Organization (WHO) (2009) also stated that WASH improvements may ensure higher attendance and better educational achievement, especially for girls.

Intervention in school WASH showed mixed results, although it aims to make a visible impact on students' health status, regularity in terms of school attendance, and educational achievement through improvement in their health and hygiene practices. In this regard, Freeman et al. (2013) found a reduction in self-reported diarrhoea among students in Kenya after a school WASH intervention. The provision

of safe WASH in schools promotes innumerable health and educational benefits such as: i) promoting WASH education by introducing students to the concepts of WASH related diseases and environmental health-related topics, ii) reducing school absence by providing an appealing learning environment for children, and iii) influencing hygiene practice and encouraging behaviour change in the students' families and community, once children also act as agents of change outside the school environment (Bar-David, et al., 2005; Poague, et al., 2022). Bowen et al. (2007) found no significant effect on diarrhoeal illness in China after the intervention in sanitation. A quasi-experimental study in Cambodia found reductions in school absence resulting from the provision of safe drinking water, though only in the dry season (Hunter et al., 2014). On the contrary, another research in Israel found no effect on absenteeism due to illness (Rosen et al., 2006).

Concerning academic achievement, Freeman et al. (2011) revealed that WASH intervention in school has no impact on test scores and school enrollment. On the other hand, the World Bank (WB) (2018) pointed out that WASH interventions implemented in schools proved statistically significant in reducing school absenteeism, poor health, and low academic performance. Likewise, the availability of functional and private school toilets and handwashing can positively affect health and learning outcomes, particularly for girls (Jasper et al., 2012). Students spend a significant part of their life at school, so the environment directly affects students' health, absence, and educational achievement. Even so, secondary exposures, such as household WASH conditions and entrenched social norms are found to be ignored in previous research.

In the context of these mixed results, the principal objective of my research is to assess whether combined school WASH facilities affect basic level students' health

status, school regularity, and educational achievement in ways that are not addressed yet in previous research. Furthermore, this research was primarily focused on assessing whether improved and unimproved school WASH facilities impact students' health status, school regularity, and educational achievement differently. The research additionally appraises the effect of theories: Theory of Planned Behaviour (TPB) and Health Belief Module (HBM) on students' health status, school attendance, and educational achievement.

Statement of the Problem

In Nepal, 76.8% of schools had water supply facilities and 79% of the total had sanitation facilities (Shrestha et al., 2017). The author further mentioned that among the having sanitation facilities (79%), only 36% had separate toilets for girls. Out of the total, 93% of students use school toilets only for urinating during school hours (Rai et al., 2015). It indicates that WASH facilities in schools are insufficient to supply reliable services. Water supply facilities and drinking water are found to have been poor and unreliable, which have a direct impact on the proper use and cleanliness of toilets and hand washing as well as hygiene behaviours (Budhathoki, 2019). Furthermore, consumption of contaminated water affects physical and cognitive performance (Hillman, et al., 2017). Nepal has high incidence of communicable disease, particularly among children, which is due to unsafe drinking water, unsanitary environment, and poor personal hygiene practices (Rai, 2018).

The inadequate WASH facilities in the schools and lack of privacies including safety measures within them results in school absenteeism at a rate of 10-20%. Of the total, 75% of all school absences are illness-related absenteeism (Lau, 2012). Sommer (2010) stated that lack of sanitation and hygiene infrastructure, including poor water access at school limits girls' attendance. A study of six rural schools in Nepal found

that the existing toilets were woefully inadequate and health education was minimal; in consequence, children, particularly girls, frequently missed school (Lovegrove, 2019). To maintain Menstruation Hygiene Management (MHM) in schools, provision of gender-segregated toilet facilities, privacy, a sufficient supply of easily accessible and clean water, a mechanism for the disposal of used sanitary materials in a private and appropriate manner, and healthcare facilities are essential. However, providing such facilities in schools has long been a neglected issue in Low and Middle-Income Countries (LMICs) like Nepal (Sommer et al., 2015).

Nepal has a high incidence of WASH-related infectious diseases due to the lack of safe water supply, inadequate sanitation, and hygiene facilities. 88% of diarrheal diseases have occurred in developing countries like Nepal (Adams et al., 2009). The incidence of diseases rates promoted high dropout rates, poor academic development, and reduced learning performance among children (Kerney, 2008). Chronic absenteeism, defined as missing more than 10% of school days in a year, highly affects students' academic performance Balfanz and Byrnes (2012), leads to poor outcome in later life and impacts social productivity. The Justice Policy Institute (JPI) (2007) mentions that WASH facilities that have a direct relationship with students' future life are being overshadowed in Nepal. This issue can be mitigated through the provision of safely managed drinking water, adequate sanitation and safely managed wastewater disposal, and good handwashing practices.

Schools are the most important place of learning for children, after the family. Additionally, students are vital agents of change (David, et al., 2005). As children spend a considerable amount of their time in schools, this is the place where they learn good health behaviours such as washing their hands with soap, using toilets properly and drinking safe water. As these facilities are limited in schools, they

cannot act as models, and teachers cannot function as role models. Against this background, school cannot influence students' families and wider communities through outreach activities by their students. Therefore, due to the lack of adequate WASH facilities and practices in schools, children are deprived from their role as agents of change regarding WASH behaviour.

Children are very eager to learn to help others through their active, energetic, enthusiastic, curious, and communicative behaviour. So, childhood is the best time to learn and form habits surrounding hygiene and the use of sanitation facilities. Children are the parents of future children and what they learn is likely to be passed on to the next generation. They have important roles in the households taking care of younger and elder members. If they are equipped with improved school WASH facilities including appropriate WASH behaviours, they can integrate as well as disseminate learned behaviour within the families, and stimulate behaviour change in their communities (Poague, et al., 2022). Being tomorrow's parents, children are also likely to ensure the sustainability of WASH facilities and the impact of behavioural change. In the literature, Budhathoki (2019), Shrestha, et al. (2018), and DWSS (2018) showed that most of the schools in Nepal have poor WASH infrastructure and practices. Based on these national and international contexts, the effects of school WASH facilities on students' health status, school regularity, and educational achievement have become the subject of investigation. The researcher is motivated to explore these questions as the problem for this study. The researcher thought that the comparison of WASH facilities available in school and the students' regularity and health status would open up new avenues in the field of health education in school. So, this study has addressed the concerns of improvement in health status, school regularity, and educational achievements of children in Nepal.

Rationale of the Study

The school WASH facility aims to make visible impacts on children's health, social, cognitive, and other developmental aspects by improving their health and hygiene practices, and those of their families and communities. Furthermore, it seeks to use WASH practices as a bridge linking children with their families and communities. School WASH practices and hygiene behaviour depend on the capacity enhancement of teachers, education administrators, families, and communities. In this perspective, there are mainly four rationales for gaining a better understanding of the research problem raised in this study.

First, the insight gained from existing research is not clear, as evidenced by the conflicting conclusions of existing studies on the topic. For example, the WB (2018) reported that WASH interventions implemented in schools showed statistically significant results in reducing students' illness, school absenteeism, and drop-outs. On the contrary, Freeman et al. (2011) showed that a WASH intervention in a school had no impact on test scores and school enrollment. Considering these mixed results, the researcher has tried to determine whether schools with improved facilities affect students' health status, school regularity, and educational achievements in Nepal.

Secondly, there is limited research on WASH facilities in schools and their effects on students' health status, school regularity, and educational achievement in Nepal. Furthermore, the limited research has been conducted through either quantitative or qualitative approaches separately, which cannot do justice in this specific topic. In addition, all research has been conducted separately in sectors such as water, sanitation, and health, and their individual consequences on the students. However, there is a need for a mixed methods approach to WASH and its effects on students’ health status, school attendance, and educational achievements. So, to fill

the existing gaps, this PhD. dissertation uses mixed-method multifactor research as a core rationale that can be the novelty of this research.

Therefore, I applied both quantitative and qualitative methods to study the research from two different lenses; directly through testing hypotheses and indirectly through obtaining respondents' perceptions that create the context of the phenomenon. The central motivation for using mixed methods is to gain a better understanding of research problems than either approach alone can provide. Furthermore, it improves research quality by gaining integral strengths and by avoiding the overlapping weaknesses.

Thirdly, almost all researchers are concerned about the non-existence of safe drinking water, inadequate sanitation facilities, hygiene behaviours, health, and absenteeism. However, research on attitude, self-efficacy, subjective-norms, and intentions concerning school WASH facilities and their impact on health, school regularity, and education is notably ignored. Previous research is almost vacant on theory-related variables such as attitude, self-efficacy, subjective-norms, and intention in school WASH facilities and their association and effects on the health status, school regularity, and educational achievement of students. So, these deserve attention and raise questions that merit an additional investigation. Thus, this research is oriented to measure whether higher scores in attitudes, self-efficacy, subjective-norms, and intentions concerning school WASH facilities are positively associated with students' health status, school regularity, and educational achievements.

Fourthly, in some schools of Nepal, toilets are useless due to either water unavailability, full septic tanks, or other reasons. Similarly, some schools have no water sources, thus students have to bring water from either home or public water sources that are located out of school for drinking and other purposes.

Moreover, students, especially females, have to spend a lot of time fetching water for domestic and school uses. As Hairabedian and Bartnik (2016) stated, the unreliability of the sources affected students' educational achievement. In this scenario, this research is oriented to obtain parents’ and students' perceptions on whether the lack of improved school WASH facilities impairs students' health status, school attendance, and educational achievements.

Objectives of the Study

The overarching objective of this study was to analyse the effect of improved and unimproved school WASH facilities on the health status, school attendance, and educational achievement for basic level students. The specific objectives were to examine the effects of school WASH facilities on:

1. Students' health status;
2. Students' school attendance; and
3. Students' educational achievement.
4. Assess the net effects of school WASH facilities on the students' health status, school regularity, and educational achievement, and
5. Explore students', teachers', and parents' perceptions on the effects on students' health status, school attendance, and educational achievements by school WASH facilities.

Research Hypothesis

Hypotheses are considered central elements of research (Lund, 2021). They are important means for attaining valuable knowledge. Several kinds of hypotheses play various roles in knowledge construction. A research problem is often followed by a research hypothesis. The research problem is considered broader than its hypothesis in the sense that the problem has several possible solutions, whilst hypotheses

correspond to one or some of the possible solutions. In quantitative research, both research problems and hypotheses are important, and a problem cannot be scientifically solved unless it is reduced to a hypothesis form. Hypotheses, then, have the important virtue of directing investigation, and relations expressed in the hypothesis guide the researcher because they are generalized relational statements.

In this study, the researcher has reviewed several theories and empirical studies before developing the hypothesis. The following hypotheses are therefore based on the empirical foundations and the research problem. The quantitative research in the dissertation tested the following three core hypotheses:

1. H_1= Students are less likely to fall sick in schools with improved WASH facilities.
2. H_1= Students are less likely to be absent in schools with improved WASH facilities.
3. H_1= Students are more likely to do well in terms of educational achievement in schools with improved WASH facilities.

Delimitations of the Study

It is challenging to cover all the subject matters in a single study due to time and budget constraints. Thus, the study was delimited on five major themes. The major delimitations of this study are discussed as follows:

First, as content, the fundamental research question focused on school WASH facilities and their effect on health status, school attendance, and educational achievement from the perspectives of the head-teacher, health teacher, students, and parents of basic level students. Secondly, this research applied quantitative-dominant mixed methods and a non-experimental casual-comparative research design. The research prioritizes quantitative methods, whilst qualitative methods played a

supportive role. Each method was applied at the same time and compared two groups of schools: those with and without improved WASH facilities, in a non-experimental fashion.

Thirdly, this research was carried out in Chitwan and Dhanusha districts in Bagmati and Madhesh province, respectively, as the study areas. Fourthly, two groups of two schools each were selected for the case, with the study units including one group with improved WASH and one serving as the control group, without improved WASH facilities. Fifthly, a structured questionnaire for students, Key Informant Interviews (KII) for head-teachers, health teachers, and parents, and an In-depth Interview (IDI) for the students, were applied as research tools. In addition, the observation checklist to observe the school WASH facilities was applied as a research tool to obtain the study's required data and information.

Operational Definitions of the Key Terms

Attitude:	How a person evaluates whether favourably or unfavourably, the behaviour of interest. It entails a consideration of the outcomes of performing the behaviour. Attitude is dichotomized into two strata; 0 to 3.80 = average or below, and 3.81 and up = above average mean score based on respondents' response to a five-point Likert scale questionnaire.
Basic school:	Grades one to eight. However, only 6, 7, and 8 grade students participated in the study.
WASH:	An acronym for "Water, Sanitation, and Hygiene". Universal, affordable, and sustainable access to WASH is a crucial public health issue in international development and the focus of Sustainable Development Goal 6 (SDG6).

Health status: The extent to which a person exhibits a condition of complete physical, mental, and social well-being and not merely the absence of disease or infirmity reported by the respondents. It measures WASH-related diseases: diarrhoea, cholera, shigellosis, salmonellosis, typhoid, and dysentery, and whether respondents experienced sickness.

Regularity: Corresponds to consistent patterns of attendance in study sessions by students on particular days or times. Regularity is defined as a lack of absences from school. A student must be absent from school for an entire day to be considered absent, excluding cases in which students left school after a half day or even after a single class.

Educational achievement: The extent to which students have attained their short or long-term educational goals. In terms of educational achievements, it represents students' obtained grades/scores in the summative evaluation.

Hygiene: Behaviours related to the safe management of human excreta, such as handwashing with soap or the safe disposal of children's feces. Hygiene thus determines how much impact water and sanitation infrastructure can have on health because it reflects not the construction but the use of such facilities.

Sanitation: Is access to and use of excreta and wastewater facilities and services that ensure privacy and dignity, ensuring a clean and healthy living environment for all. Facilities and services include the collection, transport, treatment, and disposal of

	human excreta, domestic wastewater, and solid waste, as well as the associated hygiene promotion to the extent demanded by particular environmental conditions.
Waterpoint:	Refers to any point of access to water for domestic uses. It includes a household/school connection, stands pipe, well borehole, spring, rainwater harvesting unit, or another point of transaction with a water vendor.
Blackwater:	Wastewater from the toilet contains heavy fecal contamination and has the most nitrogen in sewage.
Wastewater:	Used water from homes/schools, communities, farms, and businesses that contains enough harmful material to damage the quality of water.
Greywater:	Water from the kitchen, bath, laundry, and other domestic activities which does not usually contain much urine or excreta.
Improved WASH:	Includes the improved status of water, sanitation, and hygiene. Water includes piped water, tube well/boreholes, protected dug wells, protected springs, packaged or delivered water. Sanitation includes separate toilets, urination, and defecation for single sex with MHM facilities, separate toilets for disabled users, flush/pour toilets, ventilated improved pit latrines, composting toilets and pit latrines with a slab or platform. Hygiene includes fixed or portable handwashing facilities, including a sink with tap water, buckets with tippy-taps and jugs or basins designed for handwashing. Soap can include bar

	soap, liquid soap; powder detergent and soapy water are considered improved WASH facilities in this study.
Unimproved WASH:	These facilities include unprotected dug wells, unprotected springs, vendor-provided water, carts with a small tank/drum, bottled water, tanker-truck, and surface water sources. In terms of sanitation, “unimproved” implies no single sex toilets, no separate MHM facilities, pit latrines without a slab, bucket latrines, hanging latrines, and Open Defecation (OD) which cannot separate human excreta from human contact. In area of hygiene, it either means no handwashing facilities, or handwashing facilities without soap and running water at the water point.
Pit latrine:	Latrine with a pit for accumulation and decomposition of excreta from which liquid infiltrates into the surrounding soil.
Self-efficacy:	A personal belief in the ability to do something. It further refers to a person's confidence and belief in their ability to take action or successfully perform a given behaviour. It is dichotomized into two strata; 0 to 4.31 = average or below, and 4.32 and higher = above average mean score based on respondents' response on a five-point Likert scale questionnaire.
Subjective-norms:	Refers to whether most people approve or disapprove of a behaviour. It especially relates to a person's beliefs about whether peers and people of importance to the person think they should engage in the behavior. It is dichotomized into two strata; 0 to 3.87 = average or below, and 3.88 and up = above

average mean score based on respondents' response to a five-point Likert scale questionnaire.

Intention: The motivational factors that influence a given behaviour where the stronger the intention to perform the behaviour, the higher the likelihood of the behaviour being performed. It is dichotomized into two strata; 0 to 4.39 = average or below, and 4.40 and up = above average mean score based on respondents' responses to a five-point Likert scale questionnaire.

Organisation of the Study

The dissertation is organized as follows: The first chapter of the study presents key concerns and terms used in the research. It has traced the background of the study, statement of the problem, rationale of the study, objective of the study, research hypothesis, delimitations of the study, and definition of terms used. Meanwhile, the chapter details the WASH situation in school settings in the nation and globe. Furthermore, the chapter highlights the effect of school WASH facilities on the student's health status, school regularity, and educational achievements.

Chapter two covers an overview of available literature. Literature review includes three subthemes as review of theories, review of empirical literature, and review of plans and policies. Moreover, it presents major gaps in the reviewed literature, the conceptual framework of the study, and implications of the reviewed literature in this dissertation. The researcher reviewed three theories, namely, the Health Belief Model (HBM), Theory of Planned Behaviour (TPB), and Theory of Reasoned Action (TRA). The TPB was applied as a principle or guiding theory, whilst the HBM was used in a supplementary role. Furthermore, the researcher reviewed empirical literature that was categorized in three subthemes; school WASH facilities and students' health status, school WASH facilities and school regularity,

and school WASH facilities and educational achievements, to establish the association between existing research and the research in this dissertation. Apart from reviewing these theories and empirical literature, the research further reviewed plans and policies relating to these issues.

Chapter three provides a philosophical underpinning, research methods, pre-test, research design, research tools, study location, sample and sampling procedures, reliability and validity, data collection, and analysis procedures, as well as ethical considerations.

Chapter four presents quantitative and qualitative data analysis, interpretation, and the triangulation of the two. The chapter is managed according to the objectives. The qualitative findings were used as supportive evidence for the quantitative findings to make findings more reliable and evidence based. On the other hand, quantitative and qualitative findings may be different to each other. The quantitative data were descriptively analyzed applying SPSS version 25.0. Additionally, the qualitative information was analyzed using Dedoose 9.0.17, a qualitative data management and analysis software.

Chapter five consists of the discussion and is divided into five separate sections. The sections are organized on the basis of the five study objectives. The quantitative and qualitative findings of this study were compared with previous research findings, determining whether they are consistent or different from these previous findings. In doing so, the researcher used national and global literature related to the present study to make more sense of the study findings.

Chapter six presents the conclusion and implications of the study. The conclusions and implications were drawn from the entire research finding of this study that was understood by the researcher. Theoretical, methodological, and practical implications were presented under the implication section.

CHAPTER II

Review of Literature

This chapter presents a review of the related literature. It opens up the field, showing how the issues under study have been discussed and their core concepts have been explored, focusing on how they have been studied from different points of view, and how the field has evolved to synthesize them and identify theoretical gaps (Nakano & Muniz, 2018). Thus, this literature review has three goals; setting its theoretical background, identifying gaps in the literature, and defining the key concepts used in the literature.

The entire literature has been arranged in three core categories as: theoretical, thematic, and empirical that are arranged in a chronological order.

First, for the theoretical review, the researcher has reviewed HBM and TPB, and revisited TRA. This review was undertaken to clearly understand the dynamics of health behaviours, including the processes for changing them, and the influences of many forces that affect health behaviours, including social and physical environments. Furthermore, these theories are reviewed to identify the most suitable target population, methods, and outcomes for a compelling study.

Secondly, empirical review has been presented as subsequent to theoretical followed by policy review. Under this theme, the researcher reviewed articles from peer-reviewed journals, research papers, reports and published dissertations concerning the effects of school WASH on students' health, absenteeism, and educational achievement. For the convenience of presentation, the researcher has arranged the empirical literature into three different thematic categories: school WASH facilities and health, school WASH facilities and absenteeism, and school WASH facilities and educational achievement.

Thirdly, a review of relevant national and international policies and plans has been made in this section. National plans and policies are examined to obtain information about current health status, provisions for better health, expected outcomes, and plans for the school WASH facilities, students' health statues, school attendance, and educational achievements. Simultaneously, international policies are reviewed to understand global trends in subject matter and its influence.

Search Strategy

The Tribhuvan University (TU) electronic database for research was thoroughly used as a literature search strategy to identify and review different journal articles. Initially, search terms were divided into three categories, namely: i) Water, Sanitation, and Hygiene, ii) schools and students, iii) health status, school regularity/absenteeism, and educational achievements. Titles and abstracts of each publication were screened and checked against the inclusion criteria for a full-text review. Only studies published in English language were considered. There were no publication and location restrictions. Any article that presented a description of WASH facilities, including health status, school regularity, and educational achievements was eligible for inclusion. Considering the health status, the review considered any sorts of WASH-borne infectious diseases. Similarly, in the case of school regularity and educational achievements, the review considered studies investigating ECCD, primary, and secondary educational levels, including parents and school staffs. Related gray literature and government's reports were also reviewed. Besides these, health behaviour-related theories of change were also reviewed.

Theoretical Literature Review

The theoretical literature provides an overview of theories that have been used to explain WASH behaviour and the psychological factors that ultimately influence

health behaviour. Theoretical review helps in evaluating established theories to give an insight to the research work. The act of adequately addressing issues may require more than one theory. So, the researcher has applied two health-related theories, and in total, three theories are reviewed to extract ideas concerning the subject matter.

Since theories present a systematic way of understanding events or situations, the researcher's method of applying theories in this research is to explain and predict problems by illustrating the relationships between variables. The theories provide the researchers with tools for moving beyond intuition to begin to evaluate health behaviour based on understanding behaviour. Moreover, theories are used as the foundation for research to explain the dynamics of health behaviours, considering processes for changing them, and the influences of many forces that affect health behaviours, including social and physical environments. In addition, the process assisted in identifying the most suitable target participants, methods, and indicators to measure. For these reasons, the researcher asserts that the entire research process is based on the following theories.

Health Belief Model (HBM)

The health belief model was propagated in the 1950s by a group of United States (US) Public Health Service (PHS) social psychologists who explained why a few people were taking part in programmes to prevent and detect disease (Croyle, 2005). It has become one of the most widely used conceptual frameworks in health behaviour-related research (Champion & Skinner, 2008). It is one of the pioneering theories of health behaviour and remains one of the most widely recognised fields. The HBM attempts to examine the encouraging and discouraging factors for people practicing the healthy behaviours, and to predict health behaviours by focusing on the attitudes and beliefs of individuals. In particular, the HBM attempts to predict whether

an individual chooses to engage in a healthy action to reduce or prevent any chance of contracting a disease or dying prematurely (Nejad et al., 2005).

The HBM consists of four key constructs relating to a perceived threat and net benefits, including perceived susceptibility, perceived severity, perceived usefulness, and perceived barriers. Perceived susceptibility refers to individuals' beliefs about the likelihood of their contracting disease, while perceived severity relates to an individuals' feeling about the seriousness of the condition and its consequences, such as medical and social consequences. The combination of perceived susceptibility and severity represents a perceived threat. The other two constructs of perceived benefits and perceived barriers represent net benefits. Perceived benefits refer to individual's perceptions on the benefits gained from engaging in health behaviour. As the HBM has evolved, two constructs have been added to the original four constructs, namely cue action and self-efficacy (Champion & Skinner, 2008).

Since health motivation is its central premises, the HBM is a good fit for addressing health behaviour related to health concerns such as, school WASH facilities and the possibility of contracting disease by using school WASH facilities properly. The latest revised version of HBM consists of five dimensions: i) perceived susceptibility (how vulnerable individuals feel toward health threats), ii) perceived severity (an individual's assessment of how severe or dangerous a threat may be), iii) perceived benefits (individual's beliefs about whether a particular action will reduce the threat of illness), iv) perceived barriers (beliefs about whether an individual can overcome the difficulties or negative consequences related to executing recommended actions), and v) self-efficacy (one's perceived ability to take preventive action) (Montanaro & Bryan, 2015). Authors further added that self-efficacy was added in HBM as a model in 1988. Here, only the self-efficacy model under the HBM was

applied to understand how respondents demonstrate their perceived ability to take preventive action on their health status, school regularity, and educational achievements using WASH facilities. The researcher applied only self-efficacy in this study to understand whether one's capabilities in WASH facilities effect their health status, school regularity, and educational achievements. It further aims to examine whether there is a significant difference between students with a self-efficacy score that is above or below average, in terms of their health status, school regularity, and educational achievements.

Theory of Planned Behaviour (TPB)

The TPB grew out of the TRA, where behaviour is determined by behavioural intention, which, in turn, is predicted by attitude, subjective-norms, and Perceived Behavioural Control (PBC) (Ajzen, 1988). Additionally, the TPB constructs PBC. Attitude towards the behaviour involves an individual's evaluation of the conduct; subjective-norms refers to an individual's beliefs whether those around them would approve or disapprove of their engagement in the behaviour. The PBC is the individual's belief regarding whether the behaviour is easy or difficult to perform. As in the original TRA, the proximal behaviour determination is posited as the individual's intention to achieve the desired, intended behaviour (Ajzen, 1991).

The TPD offers a simple model of the relationships among beliefs, attitudes, and behaviour where attitude and subjective-norms are expected to predict behaviour via intention. At the same time, PBC is posited as influencing behaviour through intention (Ajzen, 1991). As per the TPD, attitudes are determined by an individual's beliefs about the consequences of their behaviour; here referring to the perceived advantages and disadvantages of behavioural enactment, namely behavioural assumptions. In a similar vein, the subjective-norm is determined through the

normative beliefs one has about whether significant others, for instance teachers, peers, and community members, would approve of their engaging in the behaviour. The constructed PBC consists of an individual's beliefs about their ability to perform the desired behaviour. Later on, an elaboration of the PBC conceptualized it as comprising two main components: internal and external controls. The internal control represents a concept similar to self-efficacy, which refers to one's beliefs regarding their ability to complete tasks and reach goals. And the second one, named the external control, refers to the extent to which individuals feel that other factors, such as time constraints and the cooperation of colleagues, could facilitate or hinder the enactment of a behaviour.

The TPB posits that the stronger one's intention, the more likely an individual will engage in the intended behaviour. Despite this, it is also significant to note that people's behaviour, normative, and control beliefs about their behavioural performance are influenced by multiple cultural, personal, and situational factors, which will likely differ across the context and culture (Warner et al., 2009). From the mentioned literature, attitude, subjective-norms, and PBC are recognized as the standard TPB variables. Thus, under the TPB, research measured respondents' attitudes, subjective-norms and intentions towards school WASH facilities to understand whether students' health status, school regularity, and educational achievements are affected. For this, scores on attitudes, subjective-norms, and intentions towards using school WASH facilities are categorized as being above or below the average mean. Further, the effects were measured based whether they were above or below the mean standard of attitudes, subjective-norms, and intentions on students' health status, school regularity and educational achievements. The below figure illustrates the original TPB framework.

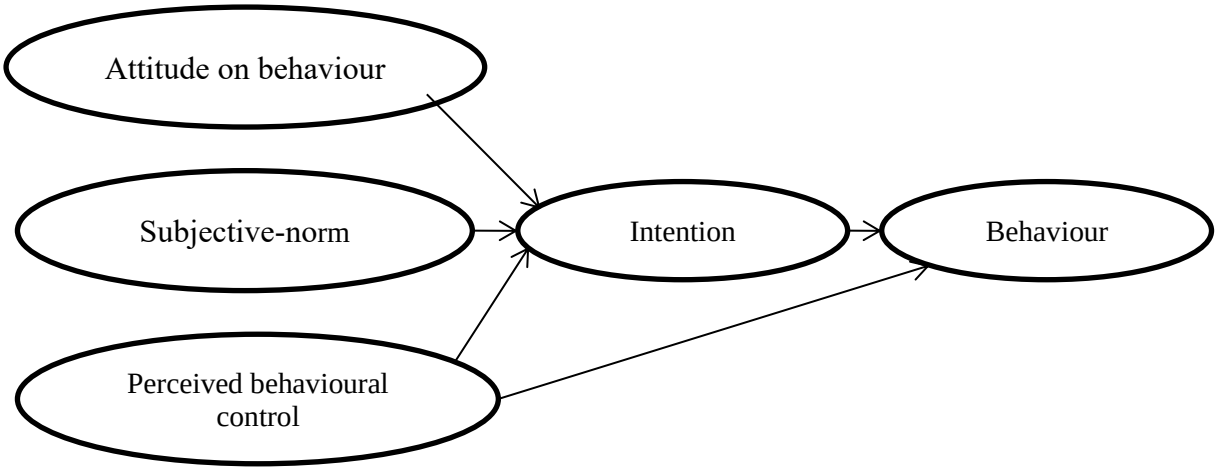

Figure 1. Theory of Planned Behaviour, Adopted From (Ajzen, 1991).

Theory of Reasoned Action (TRA)

TRA is a cognitive model developed by Martin Fishbein and Ice Ajzen in 1967. Fishbein and Middlestadt (1989) highlighted that the central focus of the model is on the prediction of behaviour that is primarily under the individual's control. As per the TRA, individual behaviour is determined by behavioural intention (Ajzen & Fishbein, 1980). The TRA illustrates mainly two factors: first, individuals' attitudes, and second, subjective-norm, which influences behavioural intention. Secondly, attitude describes an individual holding either a positive or a negative evaluation of the behaviour.

In contrast, subjective-norm refers to an individual's perception of whether significant others would think they should perform the behaviour (Ajzen & Fishbein, 1980). The significance of both factors in determining intention is expected to vary according to the behaviour, circumstances, and individual divergence. The below figure depicts the link between predictors and outcomes in the TRA model.

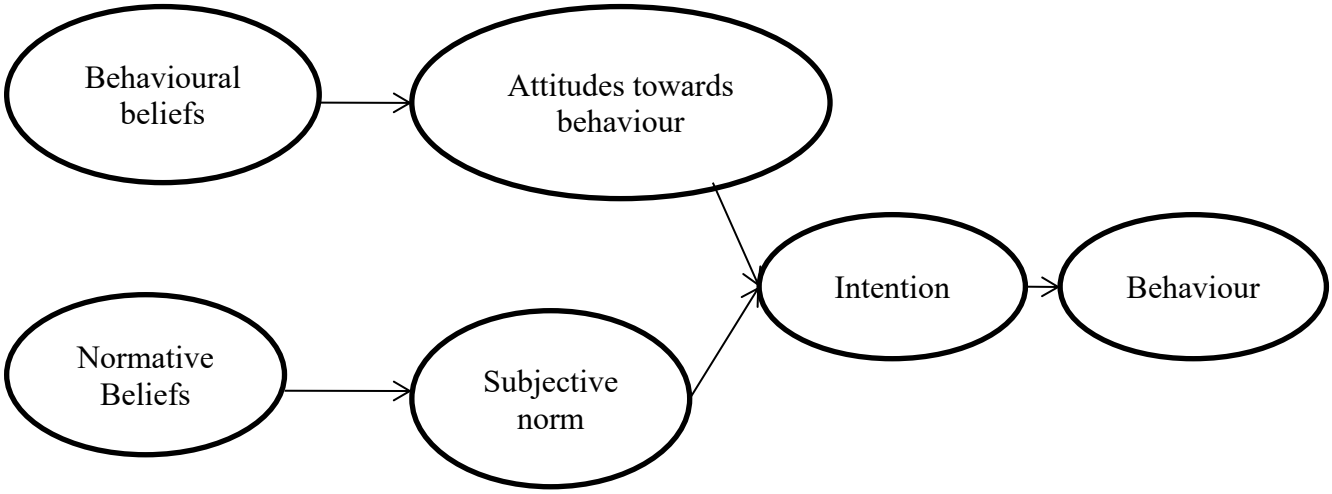

Figure 2. Theory of Reasoned Action Framework, Adopted From (Ajzen & Fishbein, 1980).

Empirical Literature Review

Research based on the observed and measured phenomena that derive knowledge from actual experiences rather than from theories or beliefs are reviewed in this section. The empirical research regarding these issues is based on themes. For the convenience of presentation, the entire empirical literature has been organized into three core thematic categories. First, school WASH facilities and health status are discussed. Secondly, school WASH facilities and school absenteeism, and finally, school WASH facilities and educational achievements are briefly explained in this section.

School WASH Facilities and Health Status

In a research carried out by McMichael (2019), schools in LICs examined the impact of school-based WASH programmes on student regularity and enrollment. The reviewed study concluded school WASH conditions might reduce student absenteeism by providing services that are required for girls during the menstruation period and reducing illness. A study in Tanzania demonstrated statistical significance

in the relationship between school WASH programmes and the mitigation of unhygienic behaviours. It increased the perceived importance of handwashing and the intention to use the toilet after an intervention in a school WASH programme. Furthermore, it found handwashing with soap at school can reduce illness in school-aged children, thereby reducing absence (Hetherington et al., 2017). The study further reported a significant increase in students' perceptions that they were engaged in health promotion activities in the community during their spare time.

Similarly, a study conducted by McGuinness et al. (2018) found that handwashing with soap is a highly effective hygiene activity in preventing infectious diseases and delivering health benefits when practiced in schools. In contrast with these findings, the study did not show an impact of school-based handwashing with soap on proxy measures of children's independent hygiene habits outside of the school. There were no statistically significant differences between interventions on handwashing facilities and sanitation related activities in students' independent hygiene habit formation (Duijster et al., 2020). In this regard Chard (2018) highlighted that school WASH related programme requires 6-12 months for students' habit formation properly. Authors further emphasized that at least 6-18 months programme would be appropriate for sustained habit formation (Chard, 2018).

An assessment in West Africa conducted by Johnson et al. (2015) assessed the WASH practices and associated factors. A cross-sectional study, collecting data from 600 heads of households, was carried out to determine WASH practices. The univariate and multivariate analyses determined the relationships between the potential associated factors and sanitation and hygiene status. Though consumption of surface water by the school and community had high health risks, the findings showed that people never used any disinfection measures. Paradoxically, people do not get

infected even they always drink infected water without disinfection measures. The lack of improved water sources and the low socio-economic status forced households to use contaminated water without purification.

The study further showed that Open Defecation (OD) was practised by most schools and households because of the lack of latrines in the school and communities. Although people know about the risks of OD, they practised it due to cultural norms. Almost all households typically discharged waste into the surrounding environment. It was caused by the absence of latrines, probably because of the low economic level of most households and infrastructure maintenance problems. In a similar vein, a systematic review conducted by Taylor et al. (2015) evaluated the impact of WASH interventions to control cholera in a LMIC. In this review, only two restrictions constituted the inclusion criteria: a clearly defined WASH intervention and a cholera health outcome or data on the function and use of the WASH intervention. The review found that most studies focused on water quality interventions, even though no study provided evidence that the water quality is the route of transformation in the reported study area. It seems that a considerable body of research highlights the general belief that cholera is exclusively waterborne, thereby ignoring other transmission routes. Moreover, most researchers perceived cholera as a waterborne infection, and different transmission routes such as the consumption of contaminated food, poor hygiene, and person-to-person transmission appear overlooked in studies.

Conversely, a review conducted by Esrey et al. (1991) concluded that the access to improved WASH yielded more significant reductions in diarrheal disease than those for water quality. The review further revealed that sanitation and water supply interventions have largely dominated in the area of diarrheal disease prevention. Taylor et al. (2015) found that most studies lacked a disease outcome or

failed to access compliance or use of the intervention. This implies that to improve the effectiveness of WASH interventions, facilities must function and usage properly, and plan should be ground and practical based for further implementation. This research further focused on appropriate leadership in the WASH sector to provide clear guidance on how best to evaluate the health impact of activities.

Abbott et al. (2013) summarised that the prevention, control, and eventual elimination of many Neglected Tropical Diseases (NTDs) depends on the availability of improved WASH in endemic countries. The author further emphasised the successful collaboration between the WASH and NTD communities which depends on commitment towards a shared vision between the two sectors, as well as measurable benefits toward each sector's principal goals and measurements of success. Not only this, the improvement of WASH infrastructure and appropriate health behaviour is necessary to achieve sustained control and elimination of many NTDs. Collaboration between disease control programmes and stakeholders in WASH sectors should result in a shared vision to make disease-free communities with adequate and equitable access to water and sanitation, and with the widespread practice of good hygiene behaviour.

Research by Das et al. (2015) in India aimed to determine the association of MHM practices with urogenital infections, controlling for environmental drivers following the case study method. This study provided the fact regarding MHM practices that the risk of urogenital symptoms are higher among women who used reusable absorbent pads than women using disposable pads. Along with this, no other MHM practices were seen to be associated with symptoms after adjusting for confounding factors and other MHM practices. The same research found that people

with MHM education have better preparedness to prevent disease and use health services more effectively.

A systematic review by Joshi and Amadi (2013) explored the impact of water treatment, hygiene, and sanitary interventions on improving the health outcomes of children. The review assessed that illness-related absenteeism constituted about 75% of all school absences and is attributed mainly to respiratory and gastrointestinal infections. Incorporating an educational component in the interventions was shown to be very effective in improving the outcomes. In the same way, access to hygiene facilities and instruction on hand hygiene behaviour improved attendance in public elementary schools during the flu season. The benefits of handwashing were more pronounced in females. The most common infections included diarrhoea and ARI. The risk factors for diarrhoea have been identified as a lack of education on hygiene practices, age of the child, area of residence, maternal education, water source, toilet facility, waste disposal, and instances of multiple children aged less than five years residing together. Accordingly, a key factor determining the child's access to safe water sources, improved sanitation, and hygiene infrastructure, was the socio-economic status of their family.

A study conducted in Northeast Ethiopia by Gizaw et al. (2019) assessed the effects of WASH education on childhood parasitic infections. This study revealed that WASH education was significantly associated with sanitation performance. Further, water safety measures, handwashing practices, and latrine utilization improved considerably after the implementation of the programme (Gizaw et al., 2019). Authors further said that WASH education at school increases the awareness level regarding WASH practices and encourages behavioural changes. Similarly, research in Mali and India demonstrated a high impact on WASH behaviour because it consisted of

Community-Based Total Sanitation (CBTS), one of the practical WASH promotional approaches to empower and develop ownership for better behavioural change. It ultimately decreases the frequency of infections (Pickering et al., 2015; Patil et al., 2014).

A cluster-randomized study by Dreibelbis et al. (2014) examined the impact of school WASH interventions on diarrhoea-related outcomes among younger siblings of school-going children. The study concluded that school WASH interventions reduced diarrhoea and gastrointestinal-related clinic visits among children younger than five years. The study also revealed that the most substantial reductions in diarrhoea and clinic visits occurred in the cluster which improved the water supply and school sanitation, hygiene promotion, and water treatment. Furthermore, it emphasised that school interventions served as essential barriers to public transmission of diarrhoeal disease pathogens among school-aged children, resulting in a reduced health burden among their siblings.

Sharma, et al. (2021), in their research report, stated that Nepal achieved the water supply-related MDGs. It has now set its specific SDG 6 targets for 2030, including achieving a basic water supply coverage of 99%, a piped water supply of 90%, and increasing improved sanitation rates to 95% of households (NPC, 2017). As per DWSSM (2019), merely 56.69% of the population has piped water coverage, and the remaining 48.31% relies on un-piped water. Discouragingly, non-piped coverage has increased from 36% in 2000 to 44% in 2017, and 48% in 2019 (JMP, 2019; DWSSM, 2019). Additionally, during these 20 years, safely managed improved water supply sources have decreased from 24% to only 18% (JMP, 2021). The decreasing trend in water supply schemes requires reconstruction and repair. Further, it indicates that water supply systems are not good at supplying reliable and sustainable water.

Poorly functioning systems result in unreliable, insufficient and unsafe water supplies, which directly impacts the proper use and cleanliness of toilets and handwashing as well as hygiene behaviours (Budhathoki, 2019).

School WASH Facilities and Absenteeism

A study carried out by Benard et al. (2016) adopted a survey research design to find out the causes of absenteeism and dropouts among girls in secondary schools in Kenya. The research showed that school dropouts, absenteeism, and low performance in the classroom are more common with girls than boys in secondary schools. The leading causes of absenteeism among the secondary school girls were i) high school fees 58.6%, ii) medical cases 25.3%, iii) domestic reasons 7.2%, iv) discipline-related causes 3.9%, and v) other causes 5%. Simultaneously, early marriage, sexual harassment, and early pregnancy were other causes of school absence and dropout of secondary school girls in the study.

Tegegne and Sisay (2014) researched MHM and school absenteeism among female adolescent students in Northeast Ethiopia, applying a mixed-methods research methodology. The research concluded that more than half of the girls had been absent from school during their menstruation. Relating to school performance, all girls perceived that menstruation influenced girls' academic performance. Many girls did not attend school during the menstruation period. When they attended, they did not participate in class attentively, thinking of the sudden leakage or the pain associated with menstruation. Worst yet, they often did not come to school on menstruation days coinciding with exam days. Significantly, the main reasons for their absence were shame and fear of sudden leakage or staining, and lack of pad or a private place to manage a menstrual period in their school.

The updated Joint Monitoring Programme (JMP) (2019) revealed that 43% of schools around the globe still lacked access to basic facilities for handwashing with soap and water (UNICEF & WHO, 2020). The report further stated that 70% of schools in LICs lack basic handwashing facilities and half of the schools lack basic sanitation and water services.

A study in Zambia examined the students' approach to education and its impact on motivation (UNICEF & WHO, 2020). The study found two opposing impacts. First, huge class sizes coupled with overworked, overwhelmed, and underpaid teachers contribute to an education system that struggles to ensure that all students are being provided with the capabilities to thrive once they leave the education system. However, the other group of children remained motivated and optimistic, viewing education as essential to their future despite having various obstacles. The report further stated that a lack of basic WASH facilities in schools led directly to increased absences for girls and a higher likelihood of dropping out of school. On the other hand, the benefits of having school WASH facilities include girls staying in school, delayed marriage, delayed pregnancy, and a higher likelihood of succeeding beyond school. School WASH facilities, including separate toilets for girls and boys, and privacy for MHM, would have a huge impact on girls' experience in school.

Globally, in 2019, 69% of schools had basic drinking water services, 63% had basic sanitation services, and 57% had basic hygiene services (UNICEF & WHO, 2020). The evidence from the meta-analysis showed that hygiene intervention reduced school absenteeism in children by 22% ($p<0.001$). Contrary, a systematic review conducted by Gera, et al. (2018) found that there is little or no effect of WASH interventions on the anthropometric indices in children. The review further presented

that there is no strong evidence to suggest a decrease in the prevalence of wasting, stunting, and underweight. WASH, especially hygiene interventions, is positively associated with a lower risk of non-diarrhoeal morbidity (Gera, et al., 2018). Research by Munn et al. (2020) stated that there is no difference between two groups of children aged between 5 to 14 years in school absenteeism whatever the reason. Similarly, absenteeism for any illness was also found to be very low-certainty evidence. In concordance with this, rinse-free handwashing is noted as a significant predictor for reducing absenteeism. In analogous, there is significant difference in absenteeism between two groups of children; rinse-free handwashing and no rinse-handwashing groups. In the same way, ARI and skin reactions had very uncertain effects on absenteeism between rinse-handwashing and no-rinse handwashing groups. Broadly speaking, there is very little evidence that interventions in WASH had an effect on compliance with school absenteeism. No authors reported substantial issues with compliance. To conclude, the majority of studies that included data on perception reported that teachers and students perceived rinse-free hand wash positively and were willing to continue its use (Munn et al., 2020).

A qualitative study conducted in Uganda entitled "menstrual health intervention and school attendance" revealed anxiety about the next period decreased from 58.6% to 34.4%, after an increase in the use of effective pain management from 76.4% to 91.4% (Kansiime et al., 2020). The study further reported that the diary data noted by the researcher, as well as the qualitative data, were consistent and indicated a potential intervention impact on improving menstruation-related school absenteeism. After the intervention, the study found that school absenteeism due to menstruation was reduced. Furthermore, girls attributed the improved school attendance during

menstruation to improved pain management, knowledge on tracking menstrual cycles, and the provision of reusable pads.

Sivakami et al. (2019) carried out a study entitled "effect of menstruation on girls and their schooling, and the facilitators of MHM in schools in India". The study showed a significant effect on school attendance in model and regular schools in various levels. For instance, the effect on school attendance is significant ($p<0.01$), as are those on concentration, ($p<0.5$), menstruation pain ($p<0.01$), and fear of stain or smell, ($p<0.01$) (Sivakami et al., 2019).

A qualitative study conducted by Devkota et al. (2020) in Nepal investigates the effectiveness of a school-based Participatory Action Research (PAR) intervention to promote handwashing behaviour with soap and water among basic level students in a community school. The research assessed students' handwashing behaviours before and after the intervention and found that handwashing behaviour with soap is positively perceived, pragmatic, and cost-effective. Additionally, the research concluded that the students' handwashing behaviours were improved due to the influence of sensitization sessions and demonstrations about handwashing. The absence of soap at handwashing facilities was found as the major barrier in sustaining handwashing behaviours among students. The researcher further stated the predominant issues in the teaching of handwashing practices include limited hygiene content in the curriculum, and the rare practical use of teaching and learning activities.

Shrestha, et al. (2020) carried a study in Nepal entitled WASH practices associated with improved height-for-age, weight-for-height, and weight-for-age among under-five years age's children. Researchers used Nepal Demographic and Health Survey's (NDHS) data and analysed by using multi-variable linear regression

to understand the association between height for age, weight for height, and weight for age, and WASH variables. The research found that sanitation coverage was associated with weight for age and height for age. Similarly, household water purification practices were associated with an increase in weight for height. Additionally, handwashing with water and soap was associated with an increase in weight for age and weight for height. Finally, this research showed the effect of water purification practice was higher for rural areas compared to urban settings ($p<0.05$) (Shrestha et al., 2020).

An analysis performed by UNICEF in 2016, entitled MHM practise in Acham, Bajura, and Parsa districts of Nepal, stated that MHM for school girls has long been a neglected issue in the country. The findings articulated that women and girls continue to face many challenges due to their gender and school-attending girls often struggle to manage their menstruation hygiene in schools. Research further showed that many girls experienced shame, fear, confusion, teasing, and lack of accurate information, advice, and support regarding their menstruation. The results also showed that many girls can not effectively manage their menstruation due to these factors, as well as prevailing negative socio-cultural restrictions and practical and logistical reasons including a shortage of soap and water, sanitary products, sanitation, and waste disposal facilities in school premeses. The mixed-gender classes were problematic because Sexual and Reproductive Health (SRH) were not taught in the classes, but left to self-study. The MHM classes focused on cleanliness to prevent diseases rather than responding to girls' queries. The girls themselves were more often a major source of information.

The same report in the school setting found that the toilets were often not clean or private, so most of the girls did not change their MHM materials or use the

toilets at school; girls who left school to go home to change usually remained at home and did not return to school that day. Similarly, almost half (45%) of the girls felt uncomfortable sitting frontline classes during menstruation days. Furthermore, some (15%) of girls in WinS schools and one-fifth (21%) in non-WinS schools, reported that they would never raise their hand to answer questions. Simultaneously, one-third (32%) of girls in WinS and 43% in non-WinS schools would never write on the board while menstruating. Half of the girls reported that they had difficulty concentrating on their classes due to discomfort, pain, and fear of leakage. Besides this, the majority of girls in both types of schools felt uncomfortable participating in sports and being in classes with boys (UNICEF, 2016).

Budhathoki (2019) reviewed the WASH supply and its situation in Nepal. In his review, the author stated that Nepal has made considerable efforts to improve the WASH situation in the country by formulating and enforcing several WASH policies, guidelines, and acts for the last two decades. From the analysis of secondary data, the author concluded that 87% of the total population has access to basic water supply facilities, and about 97% has access to basic sanitation facilities. The review further stated that the sanitation coverage is 95% in all six provinces except Madhesh province, which has below 90% (Budhathoki, 2019). Instantly after the internalization and implementation of SHMP 2011, the momentum of the sanitation coverage was accelerated, and the country came close to the elimination of OD. The review further stated that one-fourth of water supply systems are well-functioning, and more than two-thirds (68%) can supply water to water taps throughout the year. Finally, one-fourth of the existing toilet facilities across the country are poorly constructed and must be upgraded (Budhathoki, 2019).

Lovegrove (2019) stated that the existing toilets were woefully inadequate and health education was minimal in six rural schools of Nepal. Consequently, children, particularly girls, frequently missed schools. The Rotary Club of Kirriemuir, the UK working with the Rotary Club of the Himalayan Gurkhas in Nepal has constructed new toilet blocks combined with a health education programme for the 2500 children and 150 staff from the six schools. This programme provided one toilet for every 50 boys and one for every 50 girls, one disabled toilet and a separate male and female staff toilet in each school including handwashing facilities, an incinerator and a new septic tank. The schools all recruited a professionally qualified assistant to ensure all staff and children are trained in handwashing, toilet hygiene, and MHM.

Shrestha (2022) carried out a study on MHM-related absenteeism in girls. Out of 126 students, 106 (84%) of them took days off during menstruation in the past three months with an average of 2.6 days by one student. Out of 71 students who reported soiling dresses with menstrual blood as a common problem, 27% of them went home and did not return in such a situation instead of washing off at school. Similarly, 61% gave pain and 39% tiredness as reasons for taking days off. The study further stated that healthcare facilities are still lacking in schools; hence, the lack of these facilities might contribute to absenteeism (Shrestha, 2022).

School WASH Facilities and Educational Achievements

Regarding the domain of school WASH facilities and educational achievements of the students, Mahon and Fernandes (2014) revealed that cultural practices and lack of services for MHM for girls in schools impact their access to education. The study further depicted that half of the girls attending school were withdrawn by their parents once they reached menarche. The researchers claimed that the main reason is marriage either because menstruation was regarded as a sign of

readiness for marriage or because of the shame and danger associated with being an unmarried pubescent girl. Lastly, the researchers emphasized that hygiene education is necessary to promote better awareness among women and men to overcome the embarrassment, cultural practices, and taboos around menstruation that negatively impact women's and girls' lives and reinforce gender inequalities and exclusion.

Grant, Lioyd and Mensch (2015) researched on menstruation and school absenteeism using a longitudinal survey design. The study concluded that one-third of female students missed at least one day of school during their last menstrual period. However, menstruation only accounts for a small proportion of all female absenteeism. It does not create a gender gap in absenteeism, suggesting that absenteeism is not gender sensitive in the school environment.

An impact study in Western Kenya, by O'Reilly, Freeman and Hoekstra (2008) presented that school WASH reduced students' school absenteeism by 35% after providing safe drinking water, handwashing facilities, and hygiene education in primary schools. The findings are consistent with evaluations of school-based hand-hygiene programme in the US Guinan, McGuckin and Ali (2002) that showed a reduction in absenteeism following the implementation of hand sanitisers, hygiene education, or a combination of the interventions.

A study in Kenya showed high fecal contamination in the school environment because many schools have few latrines, inadequate water supplies, poor water sources, and a lack of handwashing facilities in the baseline (O'Reilly, Freeman & Hoekstra, 2008). The research further revealed that besides impacting school attendance, the burden of diarrhoeal diseases and parasitic infections harms students' growth, nutritional status, physical activities, cognitive functon, concentration, and school performance.

A study conducted by Rai et al. (2015) in the Sunsari district of Nepal using a random sampling method found that two public schools in the study area were completely devoid of sanitation facilities. Two of the toilets were unusable because one had no water (someone stole the school tube well), whereas another toilet's septic tank was full. The dried feces were scattered over the surface inside the urinals behind the school buildings. Another school remained closed because the teachers thought the students might damage the toilet structure. Very few (15%) had appropriate handwashing points besides a toilet facility; however, soap was not available. In response to the soap inavailability, it was observed that teachers brought soap from the school office room and reported that due to the low school budget, they were unable to manage soaps for all school members, including students.

Similarly, the same proportion (15%) of schools had a direct supply of water inside toilet facilities, whilst the remaining schools' students had to fetch water in the bucket from the water source outside the school yard. Further, the remaining schools had uncleaned and improper sanitary facilities. Only a few schools had found a convenient handwashing point (Rai et al., 2015).

Wilbur et al. (2021) carried out policy analysis research entitled "Are Nepal's water, sanitation, and hygiene and menstrual hygiene policies and supporting documents inclusive of disability". They concluded that inadequate MHM can negatively affect girls' education and employment, increasing the risk of sexual violence and coercion, as well as sexual and reproductive infections. The review further highlighted that the Constitution of Nepal has consistent gaps in attention to disability and MHM in policies and practices. These gaps omit people with disabilities from MHM interventions. As per the review, investment is needed to generate evidence on the MHM barriers faced by people with disabilities, which

would then be drawn on to develop training modules on these issues for professionals to improve understanding. In addition, people with disabilities face several barriers, for instance, WASH facilities, lack of relevant MHM information, and inappropriate MHM products. However, there is a shortage of MHM interventions for people with disabilities and their families, teachers, and caregivers, and this topic is still largely absent from global discourse on MHM. Similarly, the study entailed that addressing MHM issues requires a multi-sectoral response across health, education, and disability (Sommer et al., 2016).

Plan and Policy Review

In this section, several WASH related plans and policies have been reviewed to determine the efforts that have been performed to reach this moment in the subject matter. In addition, it acknowledges how the subject matter has an association with national priorities and the procedures which are planned to achieve targeted goals within a scheduled time frame.

Rural Water Supply and Sanitation National Policy 2004 & Rural Water and Sanitation National Strategy (2004)

The Rural Water Supply and Sanitation National Policy (RWSSNP) (2004) has three primary objectives: i) to provide safe, accessible and adequate water supply with sanitation facilities to all Nepalese people on a priority basis primarily targeted to the socially deprived people and ethnic groups, ii) to reduce water-borne diseases and their victims in the nation, and iii) to utilise the time and labour of women, men, and children saved from carrying water in productive work. It has adopted the policies such as: i) planning and programming, ii) technical arrangements, iii) water quality, iv) institutional management, v) legal aspects, vi) financial aspects, vii) operations and maintenance, and viii) policy monitoring and information management.

In 2004, the government committed to provide a basic level of water supply and sanitation services to support the nation's social and economic development and improve the health status of the people. The government, in this policy, is concerned about the effects of water, and states that many people are affected by water-borne and water-related diseases due to unsafe water. Moreover, the policy indicates that people have faced several problems and lost opportunities for generating income. Many women lost income and opportunities for career development due to spending several hours a day fetching water.

Similarly, the Rural Water and Sanitation National Strategy (RWSNS) (2004) has committed to providing safe and potable water and basic sanitation services to all rural parts of Nepal within the Twelfth Five-Year Plan period (2012-2017). This strategy applied gender equality and social justice, decentralization, local efforts, local resources and skills, human resource development, transparency and application of a participatory approach in the development and operation of water supply and sanitation services (RWSSNP, 2004; RWSSNS, 2004). It furthermore enhanced several aspects such as i) institutional framework; policy formulation, planning and budgeting, implementation arrangements, operation and maintenance, and monitoring and evaluation, ii) availability and selection of site, iii) appropriate and affordable technological options, iv) enhancing participation by gender, caste, and disadvantaged groups, v) health, hygiene, and sanitation, vi) financial aspects, vii) legal aspects, and viii) environmental aspects.

National Urban Water Supply and Sanitation National Plan (NUWSSNP) (2009)

The goal of the NUWSSNP is to ensure socio-economic development and improve the health status and quality of life of urban population, including poor and marginalized people, through the provision of a sustainable water supply and

sanitation services and protection of the environment. Simultaneously, it places the availability of basic safe, accessible, and adequate water supply and sanitation services to all urban population, including women, marginalized, and vulnerable groups for improved quality of life as its prime objective (NUWSSNP, 2009). However, the plan does not mention school WASH systems. So, it can be said that the plan is oriented towards improved quality of life through providing safe, reliable, adequate, and enhanced water and sanitation services to the people.

Sanitation and Hygiene Master Plan (SHMP) (2011)

The purpose of this plan is to end of OD, which is the first significant step to an entry point of behaviour change. This plan set school sanitation and hygiene parameters such as; clean toilets, handwashing stations with soap and running water, proper waste management facilities, toilets in accordance with Child Gender and Disabled Friendly Framework (CGDFF), including MHM facilities (SHMP, 2011). The CGDF feature includes water taps, handles and locks on toilet doors, and windows at suitable heights and convenience for children of different ages. The components further consist of the location of the toilet and states that the toilets should be in a safe and secure place, and the door, windows, and ventilation should safeguard privacy.

The plan illustrated the existing sanitation facts of schools in Nepal. Of the total, 61.9% of schools have at least one toilet facility, 33.9% have a separate toilet for girls, and 30.2% have different facilities for teachers. Among the students, only 47% of boys and 31% of girls have access to toilets, and 93% of boys and girls use toilets for just urinating during school hours. The availability of toilets and urinals in schools is equally essential to reduce the drop-out rate among girls during puberty.

Nepal Education in Figures (2011) AT-A- GLANCE

In the Federal Democratic Republic of Nepal, there were 33,160 basic and secondary schools. The majority of schools lack adequate access to safe drinking water, sanitation facilities, and good hygiene practices, despite several efforts to expand their coverage and quality. Of the total, 79% of schools were reported to have toilets, and only 36% have separate toilets for girls (NEF, 2011). In 2006, GoN established its National Strategy on School Health and Nutrition (NSSHN), in which the WASH in school approach is an integral part. Apart from this, the GoN solidified its commitment to child-and gender-friendly learning environments by endorsing a framework for child-friendly schools in 2010. The WASH includes about 10% of child-friendly school indicators. Furthermore, the National Sanitation and Hygiene Master Plan (NSHMP) 2011 promoted WASH in schools as a key step towards Open Defecation Free (ODF) communities and districts. From 2010 to 2011, MoE considerably increased its budget for constructing school toilets with a strong focus on increasing girls' attendance by enhancing their health and comfort in school.

Nepal WASH Sector Plan (2012)

This plan focused on schools in rural areas, especially on those schools that often completely lack drinking water and sanitation facilities or have inadequate facilities in both quality and quantity. Schools with insufficient WASH conditions and a high frequency of person-to-person contact are high-risk environments for children and school staffs (NWASHSP, 2012). The government has formulated a policy to fund local communities in the water and sanitation sectors. Besides this, they will provide some subsidies through local bodies to the poor and the people with difficulties in constructing household toilets. No other noteworthy provisions are seen in this plan.

National Water Supply and Sanitation Policy (2014)

This policy aimed to reduce urban and rural poverty by ensuring equitable socioeconomic development, improving health, quality of life, and protecting the environment through the provision of suitable water supply and sanitation services. The plan identified some significant barriers to achieving mentioned goals such as: poor and inadequate water supply in most urban areas, poor water coverage, and low supply pressure which is not potable at households and schools. Sanitation services in most metropolitan areas are very poor and sewage is directly discharged into natural water resources without treatment.

In similar ways, rural areas have traditionally treated the issue of sanitation and mainly focused on hygiene education and on-site sanitation in the family toilet and septic tank construction. It also reported that many schools in rural areas are either without a bathroom or adequate toilet. At the same time, public toilets are not user-friendly to women, children, and people with physical challenges. Besides this, school toilets have inadequate facilities in terms of water supply, sanitation, and hygiene (NWSSP, 2014).

To overcome these problems, MoE endorsed the CFSF that underscores the need for 'no schools without toilets'. It includes critical indicators related to better WASH facilities in schools, access to girls in toilets, differently abled friendliness, and the MHM approach. The implementation of this framework is ongoing in a close collaboration with the UNICEF country office of Nepal.

School Sector Reform Plan (SSRP) (2009-2015)

This plan is highly focused on the physical environment of schools, such as; the required school buildings, provision of adequate classrooms, separate gender-based toilets, drinking water facilities, and a playground. The Millennium

Development Goals' (MDG) acceleration framework on sanitation by the National Planning Commission (NPC) (2011) had declared that 'there shall be no schools without toilets' by 2015. In 2013, the Department of Education (DoE) constructed 11,500 girls' toilets and 1,102 schools as a model of a Child Gender and Disabled Friendly Framework (CGDFF) school environment (SSRP, 2009). Additionally, the Education Management Framework (EMF) for SSDP (2017) outlined a vision of Child-Friendly design and construction. For instance, these standards include i) classrooms; 0.75 sqm per children, T: 50, H: 45, M: 35 students per classroom, ii) furniture; floor seating for grades 1 and 2, iii) water supply facilities, iv) separate toilet for girls and boys. Activities supporting school water supply systems through improving environment consist of other requirements; i) water availability for drinking and sanitation, ii) tube wells should be at least 15m from soak pit or septic tank, and iii) the fencing of school and external environment improvement is entirely the responsibility of the school. Similarly, the requirements for the separate toilet for boys' and girls are: i) the boys' and girls' toilets should maintain a distance, ii) construction of ramp for wheelchair users, iii) availability of water supply and sanitation purposes, and iv) other three requirements, which have been mentioned above in supporting school water supply systems.

Fiscal Year (2013-2014)

In this fiscal year, the GoN constructed 3,000 girls' toilets and 2,000 public toilets under the Children First Education Fund (CFEF) to ensure access to WASH facilities in all schools of Nepal. Following this, in the 2014-2015 fiscal years, 550 schools from 15 districts were trained in safe health practices (Fiscal Year, 2013/14). Bajhang district was selected as a model of CGDFF WASH facilities in schools.

Nepal WASH Sector Development Plan (SDP) (2016-2030).

This plan envisions an improved public health and living standard of the people of Nepal through safe, sufficient, accessible, acceptable, and affordable WASH services everywhere and at all times. The Sector Development Plan (SDP) covers a 15-years period (2016-2030) and is divided into three phases. The first phase is the short-term period between 2016-202), the second phase covers the mid-term period between 2021-2025, and the third phase is the long-term period between 2026-2030; thus, each phase has a duration of five years (NWSH-SSDP, 2016). It is a rolling plan, which will be updated every five years. This plan has mentioned the WASH in school, an internationally adopted campaign to provide drinking water, basic sanitation facilities, and education on hygiene behaviour change to school students. Furthermore, it states that school-based WASH leads to healthier children, better educational performance, especially for girls, and enhances community-school relationships.

The protective and healthy learning environment for students in schools is a specific part of a child-friendly environment. This approach focuses on meeting the needs of students through crucial actions and provides clear pathways towards national standards for WASH in schools. The plan also emphasized three-star techniques, and the core idea behind this approach focuses on schools and their host communities that can maintain the minimum required conditions using local resources. The GoN's role is to formulate strategic actions such as providing adequate WASH services within the school. Doing so, schools should pay attention to the CGDFF technologies, with sufficient water and separate toilets for boys and girls, including handwashing with soap and MHM, safe water, clean bathrooms, and proper

hygiene education. The school must always have a sufficient ratio of squat and urinals to pupils. The schools must have garbage pit facilities on the school premises.

School Sector Development Plan (SSDP) 2016-2023 Nepal

The GoN developed and implemented the School Sector Development Plan (SSDP) from July 2016 to July 2023 for regulating its efforts to ensure equitable access to quality education for all. A five-year (2016-2021) implementation programme has been developed under this seven-year plan, aiming to improve the equity, quality, efficiency, governance, and management of education. In this five-year plan, physical infrastructure development of schools and District Education Offices (DEO) is one of the components of the SSDP. The following two activities are envisioned in the plan; 15,000 class rooms will be established with minimum enabling conditions and Disaster Risk Reduction (DRR) requirements, including the provision of WASH and construction of 50 need-based classrooms and WASH facilities by 2020/2021 (SSDP, 2017).

Water, Sanitation, and Hygiene Policy in the Time of COVID-19 (2020)

The WASH is often the first line of defense against infectious disease outbreaks like the Corona Virus Disease of 2019 (COVID-19) pandemic. As per the WHO (2020), frequent and proper hand hygiene is one of the most critical measures to control the spread of COVID-19. However, many LIC put millions of lives at greater risk to COVID-19 due to WASH service deficiencies. In the meantime, lockdown and social distancing have focused mainly on controlling the spread by limiting the contact between individuals (WASH Policy in the Time of COVID-19, 2020). However, these policies are much more challenging to implement in LMICs. The business, travel, and social activities would be resumed after the lockdown is relaxed, but the need remains for safe interaction between individuals and people. The

safety preventions should be increased in order to control the transmission of the outbreaks.

In this context, investment in public health infrastructure before, during, and after the crisis, is one of the best ways policymakers can prepare for and respond to pandemics. Investing in WASH is a no-regret policy to improve public health systems regardless of the uncertainty around COVID-19. In this scenario, the International Growth Centre (IGC) outlined short and medium-to-long-term policy options for the urban WASH sector that can target components of infrastructure delivery, institutional governance, and financing and funding. Three short term policies are recommended in the plan. They are: i) use data to assess community disease transmission and WASH capacities rapidly, ii) provide clear and actionable messages to improve sanitation practices, and iii) rapidly deploy low-cost facilities to improve access to handwashing with soap. The mid to long-term recommended policies are: i) using incentives like subsidies and loans to increase the take-up of clean water connections, ii) establishing and supporting independent regulators to ensure fair pricing and service quality, and iii) funding for WASH infrastructure should come from a combination of taxes, tariffs (user fees), and transfers (aid).

Water, Sanitation, and Hygiene Policy–Action against Hunger (2011)

In 1979, Action Contre La Faim (ACF), an international network, shared an overall vision worldwide: children and adults should have access to sufficient food and water and attain it with dignity. It has two objectives: i) to fight hunger and undernutrition globally, especially severe malnutrition, a curable disease affecting 19 million people and killing 1 million children under five every year, and ii) to respond to and be prepared for emergencies and work in disaster prevention and mitigation to save people's lives. It is estimated that every year 3.4 million people lose their life from WASH-related diseases, mainly diarrhoea.

In 2010, ACF prioritized five primary objectives in their international strategy for 2010-2015) that are: i) increasing impact on acute malnutrition, curatively and preventively, especially in young children, ii) responding to and preventing humanitarian crises, addressing vulnerability, and reinforcing long-term resilience to food, water, and nutritional concerns, iii) developing partnerships with local, national, and international stakeholders to increase the number of people assisted and promote sustainability, iv) building capacity to ensure an effective and efficient response to humanitarian crises, and v) maximizing pre-eminence as advocates and a reference source on hunger and under nutrition (WASH Policy Action Against Hunger, 2011).

The principal concept of ACF's policies and strategies is the same as the initial phase; however, projects are undertaken in partnership with stakeholders and communities involved to achieve a more substantial and sustainable impact. It was performed by up-scaling activities, intervening judiciously through contingency and immediate response and with concern for accountability by promoting and organizing external audits, while maintaining that this focus on coverage should not come at the expense of the quality of the intervention. Still, it should instead guide the organization in seeking alternative strategies, from partnerships to promoting human rights. It emphasized coherence with methods of other actors and combined several sectors with common targets and beneficiaries like support to nutrition and food security projects. In addition, health data, especially regarding nutrition, is primarily used to guide entry and exit points for WASH interventions and validate their impact. WASH infrastructure coverage data is deemed to be a second step in the selection of areas for action.

ACF WASH intends to expand its focus to cover peri-urban settings, including eco, care practices, handwashing promotion and Disaster Risk Management (DRM). Low-cost and appropriate replicable technologies, public/private partnerships, value chain and social marketing, integrated natural resources management, and enhancing

institutional support mechanisms will be explored as critical approaches towards increasing coverage and sustainability. Research and organizational learning are inextricably linked to ACF WASH interventions to share and replicate good practices.

The ultimate goal of the WASH programme under the ACF is to invest in reducing the mortality and morbidity rates, especially for under-five year children through: i) investing in preventing and treating acute undernutrition, ii) addressing the survival needs of populations, iii) reducing the risk of the spread of and vulnerability to WASH-related diseases, iv) supporting food security, livelihoods and socio-economic development of vulnerable communities, and v) building population's resilience to crisis.

Water-Aid Nepal Country Strategy (2017-2021)

The Water-Aid Nepal national vision (2017-2021) is to reach everyone, everywhere, with safe water, sanitation, and hygiene by 2030, helping them to live healthy and dignified lives. Its overall goal is to ensure that marginalized groups and individuals living in vulnerable situations in Nepal have access to safe water and improved sanitation facilities and can practice good hygiene behaviour. Similarly, the mission transforms the poorest and most marginalized civic lives by enhancing availability and access to safe WASH. Although Nepal has made remarkable progress in WASH development, there are still 2.3 million people living with no access to safe water and 15 million people with no access to sanitation facilities (WaterAid Nepal, 2017). Water and sanitation-related diseases are among the top ten most serious public health issues and the top five reasons for death in children under five.

The strategy further reported that access to WASH is a significant challenge for Nepal because of its extreme political, social, geographical, and economic barriers. Critical areas like health, education and economic growth are also affected

by poor WASH infrastructure, holding back the country's development (WaterAid Nepal, 2017). It has made the following four key objectives:

1. Enable marginalized and vulnerable situations people and communities to act for their rights to water and sanitation.
2. Promote greater accountability and effectiveness for delivering WASH services.
3. Influence and demonstrate WASH as foundational to all aspects of development with a focus on health and education.
4. Apply new research, holistic approaches, and innovative technology to WASH.

The Water Aid strategy further designed four interconnected flagship programs to support mentioned objectives that are: i) reaching the unreached, ii) recovery and resilient WASH, iii) hygiene, and iv) sector effectiveness. It has committed to working according to need, based on the basis on Human Development Index (HDI).

Sustainable Development Goals (SDGs) (2016-2030)

Sustainable Development Goals (SDGs) are an internationally agreed set of shared development goals. Nepal is committed to pursuing and achieving the SDGs by 2030. These are broadly aligned with the social, economic, and environmental aspirations that Nepal has set for itself in its new constitution. So, it can be said that SDGs are not just an international set of agreed goals; they are a way forward for Nepal's development.

The SDGs envision goals Nepal within the end of 2030. While all the 17 SDGs and 169 targets are legitimate development objectives seen through a global lens, a resource-strapped country like Nepal needs to prioritize, localize, and motivate a bottom-up path towards progress (SDGs, 2016-2030). Before 2030, Nepal graduated from the Least Developed Countries (LDC) to LMIC as defined by United Nations. Nepal met almost all MDGs between 2000 and 2015. The SDGs are not just an

expansion of goals and targets, but they address complex issues, such as inequality and human rights. This is a holistic approach to development, including 17 goals, and is presented below (Table 1).

Table 1. *SDGs and proposed Milestones by the end of 2030*

SDGs	Proposed Milestones
Goal 1	End poverty in all its forms everywhere
Goal 2	End hunger, achieve food security and improved nutrition and promote sustainable agriculture
Goal 3	Ensure healthy lives and promote well-being for all at all ages
Goal 4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
Goal 5	Achieve gender quality and empower all women and girls
Goal 6	Ensure availability and sustainable management of water and sanitation for all
Goal 7	Ensure access to affordable, reliable, sustainable, and modern energy for all
Goal 8	Promote sustained, inclusive, and sustainable economic growth, full and productive employment and decent work for all
Goal 9	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
Goal 10	Reduce inequality within and among countries
Goal 11	Make cities and human settlements inclusive, safe, resilient and sustainable
Goal 12	Ensure sustainable consumption and production patterns
Goal 13	Take urgent action to combat climate change and its impact
Goal 14	Conserve and sustainability use the oceans, seas, and marine resources for sustainable development
Goal 15	Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
Goal 16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive.
Goal 17	Strengthen the means of implementation and revitalize the global partnership for sustainable development

The SDGs can be divided into 5 clusters. First, essential marks of civilization include four goals: 1, 2, 6, and 7 that deal with ending poverty and hunger and providing basic water sanitation and modern energy for all citizens. Secondly, the exercise of human capabilities and agency includes two goals: 3 and 4, which deal with healthy lives, quality education, and lifelong learning. Thirdly, the cluster of higher human aspiration consists of three goals: 5, 10, and 16, each dealing with achieving gender equality, reducing inequality, and securing peace, access to justice, inclusive institutions, respectively, resembling the higher aspirations of modern, democratic nation-states. Fourthly, the category pertaining to the means for sustained progress includes three goals: 8, 9, 11, and 12, each of which are related to economic growth, jobs, resilient infrastructure, industrialization, cities and settlements, and sustainability of consumption and production, each of which are about generating and sustaining resources to improve the average quality of life and human dignity. Fifthly, threats to future prosperity include three goals: 13, 14, and 15, which are related to the protection of the global commons.

As understood, the first three sets of goals are mainly national, the latter two regionals, and the remaining are global in scope. SDG 6, ensuring availability and sustainable management of water and sanitation for all, is closely related to my PhD. dissertation. This goal includes:

1. Achieving universal and equitable access to safe and affordable drinking water for all.
2. Gaining access to adequate and equitable sanitation and hygiene for all and ending OD.
3. Improving water quality by reducing pollution, eliminating dumping, and releasing hazardous chemicals and materials.

4. Substantially increasing the efficiency of water usage throughout all regions.
5. Implementing integrated water resources management at all levels.
6. Protecting and restoring water-related eco-systems, including mountains, forests, wetlands, rivers, aquifers, and lakes.

Furthermore, SDG 6 sets targets for basic water supply coverage at 99%, piped water supply at 90% and improved sanitation at least 95% of households. Along with this, the target includes enabling 98% of the population to have access to sanitary latrines.

Major Gaps in the Existing Literature

Going through the literature, the researcher found some critical gaps at the outset which are as follows:

First, WASH facilities in schools and their effects on students' health have limited research in the Nepalese context. Secondly, this limited research has been conducted through either solely qualitative or quantitative approaches. Thirdly, the researchers found widely practiced OD and deficient safe health practices among children in schools (handwashing with soap and drinking safe water); however, existing research has not addressed the consequences of the OD practices, or possible remedies.

Fourthly, the body of literature contains mixed results, such as the World Bank (2018) reporting that WASH interventions implemented in schools had a statistically significant result in reducing absenteeism and drop-outs. Conversely, at the same time, another study by Freeman et al. (2011) showed that the WASH intervention in school had no impact on test scores and school enrollment.

Fifthly, Nepal has prioritized WASH sectors officially since 2004 in the Rural Water Supply and Sanitation National Policy (RWSSNP) 2004 & Rural Water and

Sanitation Strategy (RWSNS) 2004 to achieving the Sustainable Development Goals (SDGs) 2016-2030. The prominent purpose of the several plans, policies, and goals are to provide safe, accessible and adequate water supply with sanitation facilities to all Nepalese and to mitigate dreadful incidents such as high number of water-borne diseases. However, the Nepalese people face high number of WASH borne disease, including diarrhoea, dysentery, typhoid, gastroenteritis, and cholera.

Now, researcher found several studies regarding school-based water, sanitation, and hygiene that explored its practices and behaviours separately. Furthermore, this research assessed WASH facilities and their association with and effect on several variables separately. Significantly, almost all research has been focused on the non-existence of safe drinking water, inadequate sanitation facilities, and hygiene behaviours. Even so, studies did not appear to be jointly conducted regarding school-WASH facilities. Following this, most plan and policies did not highly prioritize school WASH facilities and their consequences on students' school regularity and educational achievements. So, the present research is focused on how school WASH facilities jointly effect students' health status, school regularity, and educational achievements, which was found lacking in previous studies. Apart from this, this research is specifically concerned with whether the effects of improved vs. unimproved school WASH facilities on the aforementioned variables differ significantly, which is overlooked by previous research.

Conceptual Framework of the Study

Throughout this dissertation, the researcher applied the framework below to address the intended objectives in this study.

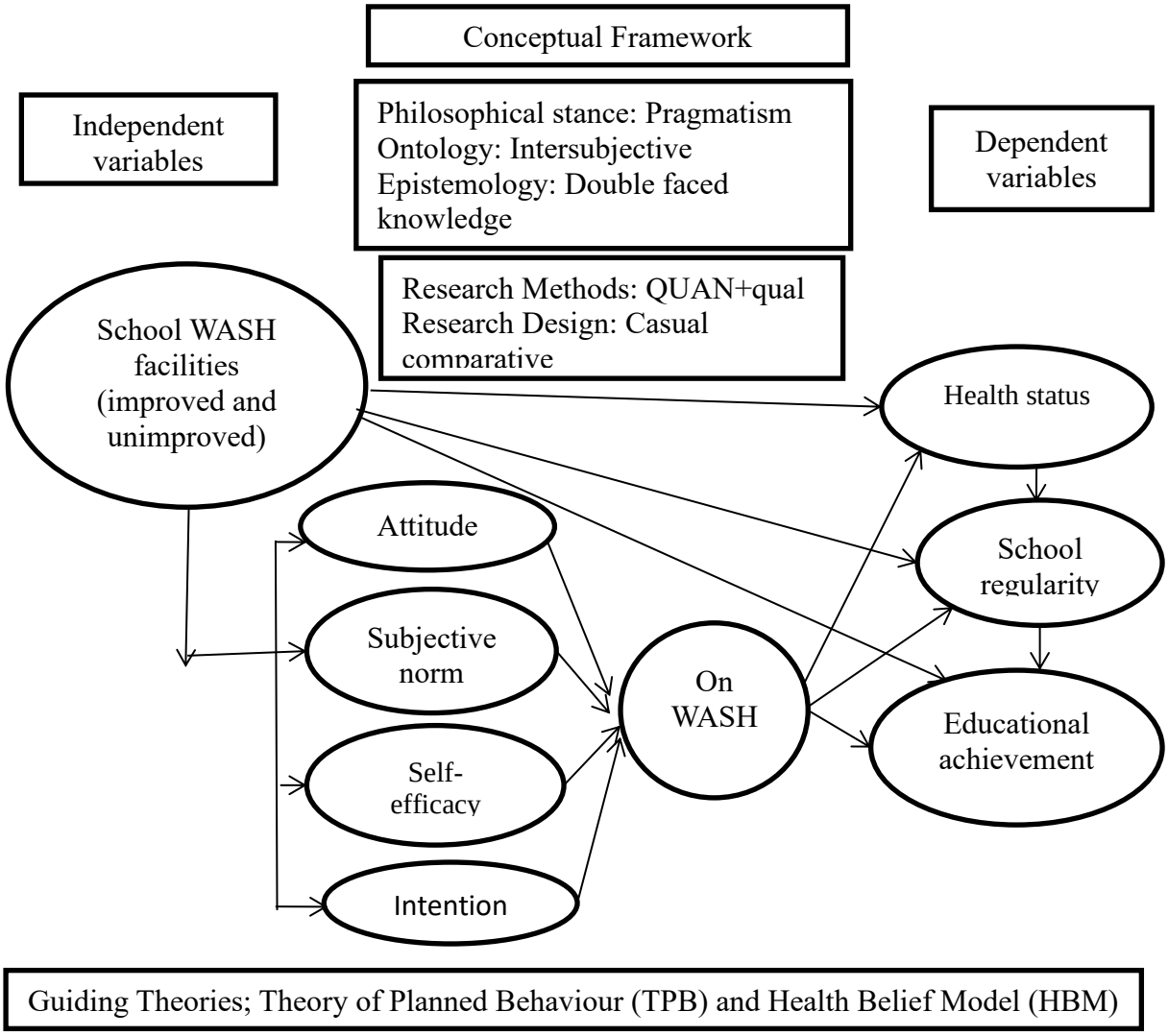

Figure 3. Conceptual Framework of the Study

The philosophical stance of this study is pragmatism. It is a philosophical paradigm of research. It depicts relativist (multiple reality) or intersubjective (objective and subjective) reality in the same study. At the same time, it accepts both types of reality; existence of one reality and subjective interpretations of the reality by individuals. The epistemological stance is conceptualised as double-faced knowledge. It includes two sorts of knowledge: observable knowledge, which can be obtained

from a quantitative research method known as positivism. Secondly, unobservable knowledge can by acquired from the interpretive paradigm denoted by the qualitative research method.

This study used mixed-method research, namely, a quantitative-dominant concurrent mixed-method known as "QUAN+qual" (Johnson, Onwuegbuzie, & Lisa, 2007). Furthermore, it applied causal comparative/ex-post facto research design to collect, analyse, and combine quantitative and qualitative data (Creswell & Plano, 2013). The central premise of using mixed methods is to better understand research problems by converging quantitative and qualitative data and comparing the two databases rather than approaching each alone. Furthermore, understanding both types of methods and studying the same phenomenon from two different positions justifies the concurrent mixed research approach and makes triangulation and cross-validation logical.

The primary independent variables are school WASH facilities of both the improved and unimproved varieties. At the same time, students' attitudes, subjective-norms, self-efficacy, and intentions are secondary independent variables, whilst students' health status, school regularity, and educational achievement are dependent variables (Figure 3). As mentioned in the earlier models; self-efficacy is considered by HBM, whereas attitudes, subjective-norms, and intentions are considered by the TPB. These four models also examine respondents' health status, school regularity, and educational achievements concerning school WASH facilities. The TPB is the guiding theory for this study because most variables are derived from this theory.

Meanwhile, the critical effecting/measuring factors are health status, regularity, and educational achievement. First, the health status of the respondents includes sickness as a measure of the health status of the students and assessed

through students' self-reporting and verified through official school records and parental responses. Sickness was assessed to establish whether respondents became sick from WASH-related diseases like diarrhoea, cholera, shigellosis, salmonellosis, typhoid, and dysentery. At the same time, in analyzing the sorts of diseases that they contracted, the researcher considered the causes of sickness and obtained variables related to curative systems in health status.

Secondly, student absences were measured by students' self-reporting and were cross-checked with the official attendance record. It was further verified through parental reporting because targeted students ranging from grades 6, 7, and 8 and their parents can remember whether they had been in schools due to sickness and or other causes. A student had to be absent for the full day to be considered absent for the purpose of this study; in other words, if students left school after half day or even after a single class, they are not here considered to have been absent.

Thirdly, educational achievement is constituted by learning outcomes such as: test scores or Grade Point Average (GPA) obtained by students in the final examination. It was assessed through the students' self-reporting and verified the score through the school authority record for grades 6 and 7, and through the Education Development Coordination Unit (EDCU) for grade 8.

Implications of the Review for the Research

Since the researcher has reviewed theories, empirical literature, and plans and policies relating to school WASH, the review has certain implications for this study.

Initially, theories such as HBM, TPB, and TRA were reviewed to understand how their variables relate to students' WASH behaviour. This theoretical research generated four variables: attitudes, self-efficacy, subjective-norms, and intention, and the study determines for each whether the scores being above or below the mean

affects students' health status, school regularity, and educational achievement. As Norman et al. (2007) stated, these were applied from the theoretical literature to articulate the mentioned variables, by making hypotheses and defining the context and scope of the study.

Secondly, several plans and policies relating to WASH were reviewed in the discussion to enrich the findings of the present study. The review formed the basis for high-quality research and helped maximize relevance, originality, generalizability, and impact, and is mentioned in the implications section of the study. Thirdly, the student reviewed national and global research, which implied obtaining context, acknowledging methodology, identifying innovation, minimizing duplicative research, and ensuring that professional standards are met. As Maggio et al. (2016) suggested, the student further applied a literature review to articulate clear objectives, show adequate preparation, select appropriate methods and design, formulate the conceptual framework, communicate relevant results, and engage in reflective critique. The literature was utilized as a critical step toward identifying relevant conceptual frameworks. It also pointed to investigating the research gaps for this study and applying a pragmatic research approach. The findings of the reviewed literature were compared and contrasted with the findings of the present study, thereby enriching and making the current findings more realistic.

CHAPTER III

Methodology and Procedures

The study aims to analyze school WASH facilities in relation to health status, school regularity, and educational achievement among basic level students in Nepal. The preceding chapter presented the literature review and highlighted essential research gaps. Now, this chapter provides an overview of the methodology and the procedure employed in this study. This section, therefore, presents the research paradigm, research method, research design, population and sample size, sampling procedure, research tools, data collection procedure, data analysis procedures, and ethical considerations that were applied in the study.

Philosophical Paradigm

A pragmatic research paradigm, as discussed by Lincoln et al. (2011), is used in this research. It is a unified and integrated paradigm which conceptualizes ontological and epistemological stances. It integrates quantitative and qualitative research approaches as two integrated, rather than conflicting, philosophies (Maarouf, 2019). The quantitative paradigm is based on objectivism or positivism. Creswell (2014) describes objectivism as the belief in to one objective reality which is separate from the researcher's perceptions. The researcher is independent of the phenomenon under investigation and does not affect the phenomenon. Sale et al. (2002) mentioned that the main aim of the quantitative paradigm is to measure causal relationships between independent variables and dependent variables using a value-free framework.

The quantitative research paradigm collects and analyses quantitative data (Johanson & Christensen, 2012). It is a deductive approach. The main aim is to test theories and hypotheses by examining the relationships among variables (Antwi & Hamza, 2015). However, the theory and hypothesis tested in the quantitative research

paradigm may disregard some important variables and not reflect the local social understanding. On the other hand, the qualitative research paradigm involves subjectivism, which believes in the existence of multiple realities, which depend on the researchers' construction of reality. It relies on collecting and analysing qualitative data by using an inductive approach (Johanson & Christensen, 2012). This paradigm explores in-depth information and understands individuals or groups' meanings attached to the subject matter (Bryman & Bell, 2007). However, the knowledge produced from this research paradigm cannot be generalised in another contexts. So, the integrated philosophical paradigm, also known as pragmatism, is applied as the mixed-method research approach. Pragmatism as a paradigm is the integration of the subjectivism and objectivism paradigms. Accordingly, this paradigm creates findings using value bound research.

By clarifying these stances, I believe that pragmatism can serve as the philosophical partner for the mixed-methods research approach. It is the paradigm that has the potential to win the paradigm war by ending the debate between quantitative and qualitative approaches. Furthermore, it opens all possible options to the researchers, making it prevail over all other research philosophies.

Thus, the pragmatic paradigm is my philosophical assumption. It is the entire set of beliefs that guides the actions and defines the worldview of this research. It allows the researcher to use all research approaches to understand the problem (Creswell, 2009; Lincoln et al., 2011). It suggests using the most helpful method to the investigation (Creswell & Plano-Clark, 2011). As Teddlie and Tashakkori (2009) presented, the pragmatic paradigm is the approach most associated with mixed-methods research. For these reasons, pragmatism seems to be suitable for this study

due to the methodological freedom which allows for the researcher to focus on and answer the research questions.

Ontology of the Study

As this study followed the pragmatic philosophical paradigm, the ontological basis of this study is relativism. In this regard, Morgan (2007) stated that the pragmatic paradigm is "intersubjective," in that it deals with subjective and objective reality simultaneously. It furthermore accepts both the existence of one reality and the fact that an individual can have multiple interpretations of that reality. Moreover, Saunders et al. (2009) mentioned that pragmatism implies external and multiple realities. The researcher concurs that reality does exist; however, it is constructed within the human mind. So, the ontology of pragmatism asserts that nobody can know the truth perfectly because of the researcher's human limitations. It is also known as critical realism, through which the researcher can discover reality within a specific realm of probability (Mertens, 2009).

The researcher has selected this view as the one best able to serve the research objectives. As Johnson and Christensen (2012) stated, the researcher used a mixed-method approach to understand both reality's objective judgment and its subjective opinions. In other words, the researcher applied intersubjective reality or a reality cycle through quantitative and qualitative methods to fulfill the research objectives of the study. The reality cycle refers to the fact that only one reality exists in a particular context at a certain point in time; however, the reality depends on the context to exist and continue existing. Accordingly, if we see the changing context, the change of reality and the existence of multiple contexts means the existence of multiple realities. In this research, the reality is relative to how individuals experience school WASH

facilities and their effect on health status, school regularity, and educational achievement.

As a pragmatic researcher, I based my work on two realities; one is external reality, and the other is the multiple perceptions of reality which emerge in respondents' minds. This division necessitate the use of both quantitative and qualitative research approaches and methods. First, to adopt the one reality view, the researcher used the quantitative approach and tested theories and hypotheses about reality. Secondly, the researcher applied a qualitative approach to examine the participants' perceptions about the reality and provide a deep understanding of the context generating that reality. In this research, ontology is built on the existence of one reality in a certain context and multiple perceptions of this reality in participants' minds; not the existence of multiple realities based on researchers' construction of reality. The purpose of using qualitative methods is not to construct the reality as a unique interpretation of the researcher but to discover the reality, this single truth that already exists, by means of investigating the participants' perceptions. During the study, the researcher did not assume that the multiple realities through the qualitative research are unscientific, and therefore, quantitative scientific research should validate it. The researcher only aimed to confirm that the qualitative research findings can be integrated with quantitative results because they provide a simplified view of reality better suited for the practical goals of pragmatism.

Epistemology of the Study

Double-faced knowledge is an epistemological foundation of this research. Double-faced knowledge is a type of knowledge that integrates observable and unobservable knowledge based on the ontological stance of the researcher, not on the nature of knowledge itself (Maarouf, 2019). The researcher applied the quantitative

research method as a positivists' paradigm dealing with observable knowledge in the same inquiry. Similarly, the researcher used the qualitative research method as an interpretive paradigm that deals with unobservable knowledge. As a pragmatic researcher, the researcher accepts both types of knowledge based on the primary concern of choosing the correct research method that best serves the research objectives.

All sorts of knowledge in this study is either observable or unobservable by nature. The variables like attitudes, subjective-norms, self-efficacy, and intentions cannot be measured in the same way as quantitative surveys (Ma, et al., 2012). The researcher used quantitative, non-experimental techniques to deal with the source of knowledge; techniques which limit human responses to a certain number of structured answers in order to make measurements. Similarly, to describe the research issues through the qualitative approach, the researcher used detailed descriptions of the subject matter and its meanings with the source of knowledge. As a pragmatic researcher, the researcher accepts both the existence of one reality and the importance of respondents' perceptions of the reality, as these provide more detailed and deeper understanding of the reality. From the double-faced epistemological stance, the researcher moved between objective and subjective paradigms. As a consequence, both observable and unobservable knowledge is accepted in this research.

A major underpinning of pragmatist epistemology is that knowledge is always based on experience. Our social experiences influence our perceptions of the world. Each person's knowledge is unique as their unique experiences create it. Besides, much of these sorts of knowledge is socially obtained because it is generated from socially shared experiences. Thus, all knowledge is social knowledge (Morgan, 2014). As Rorty (1980) articulated, pragmatic epistemology does not view knowledge as

reality. Instead, it is generated with the purpose of better managing one's existence and taking part in the world (Goldkuhl, 2012).

As a pragmatic researcher, the researcher believed that no objective truth exists and is waiting to be discovered. This epistemological stance assumes that human knowledge is not based on a prior assessment from an objective individual but rather upon conjectures. The value of this research is in generating contextual understandings of school WASH and its effect on health status, school regularity, and educational achievement from the perspectives of students, teachers, and parents. Thus, the sources of information, so far included in the study, such as students, teachers, parents, and the researcher’s personal observations, constitute the epistemology of the research.

Mixed-Methods Research

This study used mixed-methods research to collect, analyse, and combine quantitative and qualitative research data (Creswell & Plano, 2013). A concurrent mixed-methods approach with quantitative dominant "QUAN+qual" as given by Johnson, Onwuegbuzie and Lisa (2007) was applied. It was perceived as the most appropriate means to assess students' health status, school regularity, and educational achievement. Morse and Niehaus (2009) stated that the use of capital letters for 'QUAN' suggests that this part is primary, while the use of lower letters for the 'qual' component means this is secondary or supplemented information, while '+' denotes the concurrent research design (Morse & Niehaus, 2009).

The central premise of using mixed methods is that converging quantitative and qualitative data and comparing the two data sets allows for better understanding of research problems than either approach alone. Furthermore, the researcher applied mixed-methods research because it seeks elaboration, enhancement, illustration, and

clarification of the results from another method (Greene et al., 1989). By combining inductive and deductive thinking, the researcher emphasized the knowledge claims on pragmatic grounds (Creswell & Plano-Clark, 2011). Moreover, this method asserts both the quantitative and qualitative methods for studying the same phenomenon from two different perspectives, either directly while testing a theory/hypothesis describing the phenomenon or indirectly by investigating participants' perceptions that create the context containing this phenomenon. Hence both methods are studying the same phenomenon from two different positions. This justifies the concurrent mixed-methods research approach and makes the triangulation and cross-validation totally logical. It supports the essence of integrating mixed methods with a pragmatic philosophical paradigm.

Sale et al. (2002) stated that the two main advantages of using mixed-methods research are complementary strengths and triangulation. The complementary means using the strengths of one research method to enhance or support another one. The mixed-methods researcher believes that using only quantitative or qualitative research is limited and insufficient for addressing a research problem. Based on the views of Johnson and Christensen (2012) and Sale et al. (2002) who stated that every approach has its strengths and weaknesses; the researcher combined them in a way that improves research quality by gaining integral strengths and avoiding overlapping weakness. The second advantage of triangulation is to enrich and strengthen research results by using different data collection and analysis methods to study the same phenomenon in order to gain a complete understanding of this phenomenon. As Molina-Azorin (2016) stated, triangulation was used to check on findings from a particular (quantitative) method with findings reached by another one (qualitative).

For this, the data were collected, analyzed, and mixed, inferences were drawn from this data using both the quantitative and qualitative methods (Tashakkori & Creswell, 2007). The researcher used the quantitative data to test the TPB and HBM models that predict whether the school WASH services positively or negatively affect the students' health status, school regularity, and educational achievements. In addition, the qualitative data was used to explore the phenomenon which hinders students' health status, school regularity, and educational achievement. Lastly, the quantitative and qualitative findings were blended in a process where the qualitative findings were used to support the quantitative findings and to show their differences.

Pre-test

The pre-test of the quantitative tool was carried out in a basic school with similar grades (6, 7, and 8) of students at the Kavreplanchowk district of Nepal. Al together, 18 students participated. Croanbatch's alpha or coefficient alpha is calculated to measure internal consistency, that is, how closely related a set of items were as a group. A score of more than 0.7 is usually okay in each questionnaire set, and in this Croanbatch's test/pre-test, the researcher obtained ≥ 0.8 to 0.9 scores in all sets of research items. The score indicates that the set of items are well-correlated and suitable for real field implementation.

Notwithstanding these acceptable scores, the researcher revised the unclear, obscure questions and complex items were reworded based on the reviewers' comments. These questions measured latent variables and hidden/unobservable variables such as respondents' attitude, self-efficacy, subjective-norms, and intentions on school WASH facilities, which were very difficult to measure in real life. Croanbach's alpha showed that the set of questionnaires were closely related as a group and were eligible for real field implementation.

Research Design

As the research followed mixed-methods methodology, it applied a causal comparative/ex-post facto research design (Johnson, Onwuegbuzie & Lisa, 2007). The design consists of a single phase and starts with collecting and analyzing both quantitative and qualitative data at the same time separately. The core component is quantitative, and the additional feature is qualitative. Processing this design, the researcher relayed a quantitative view of the research process, recognizing the addition of qualitative information and approaches. The below figure depicts the research design that has been applied in the study.

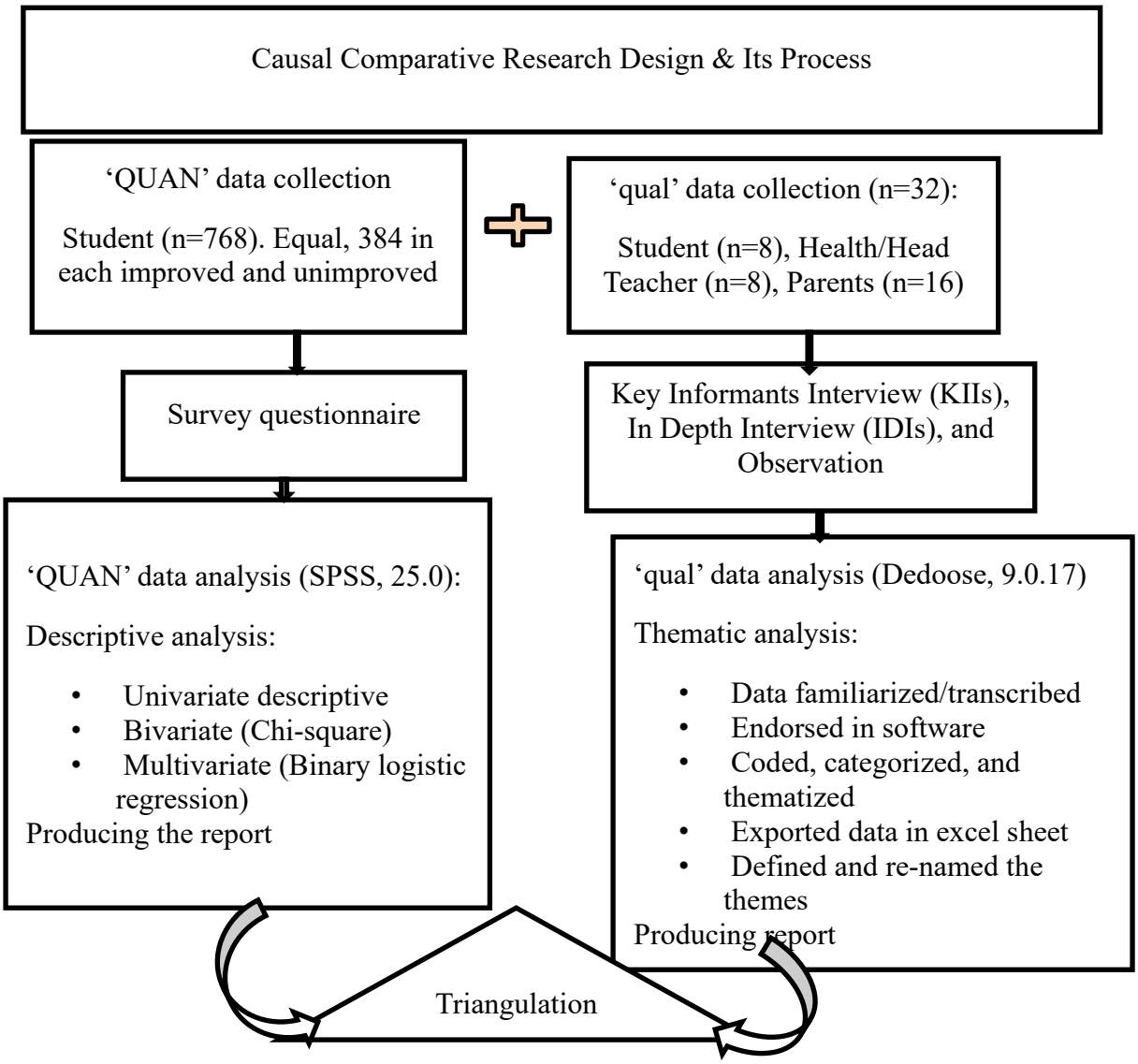

Figure 4. "QUAN+qual" Mixed Method & Causal Comparative Research Design.

Study Population

The sample frame consisted of all students (n=1342) of four basic schools studying in grades 6, 7, and 8 in two districts (Dhanusha and Chitwan) of Nepal. In addition, head teachers, health teachers, and parents of students in the same districts were part of the study population.

As mentioned above, this mixed-methods study used a non-experimental causal-comparative research design. The researcher sought to identify a difference between students' health status, school regularity, and educational achievement with improved and unimproved school WASH facilities in basic schools. The study was carried out within the two groups; the intervention group included those who had access to improved facilities, and the comparison group consisted of those with access to unimproved school WASH facilities. In this design, the researcher investigated the association of independent variables with dependent variables by comparing two groups. The independent variable is whether the WASH facilities at the school are improved or unimproved (JMP, 2018). This data was obtained through consultation with the Education Development Coordination Unit (EDCU) of concerned districts. It was also confirmed by the researcher's direct observations based on JMP (2018) norms.

The school WASH facilities being improved and unimproved, constituted the independent variables, whereas students' health status, school regularity, and educational achievement were dependent variables. As Borg et al. (2007) stated, the researcher tried to identify the cause and effect between and among the independent and dependent variables by applying a causal comparative research design. In such a design, the independent variable is the type of WASH facilities in a school, whereas

students' health status, school regularity, and educational achievements are considered dependent variables.

Study Area

The study took place in Dhanusha and Chitwan districts from Madhesh and Bagmati province, respectively. The purposive sampling method was applied while choosing the provinces. Madhesh Province is considered to have low sanitation coverage 88.19%, whereas Bagmati Province is considered to have high water supply coverage 91.01% (DWSS, 2018). The existing low sanitation and high-water supply coverages were estimated based on the data collected and recorded by the DWSS.

Employing the purposive sampling method, the researcher selected only two schools from each district: one with improved and another without improved WASH facilities, so the study altogether comprised four schools. Based on the EDCU consultation, the schools were selected and finalized with the researcher's self-observation based on JMP (2019) guidelines. The JMP has developed new WASH service ladders: advanced, basic, limited, and absent WASH services. These are used for global monitoring of WASH in schools to make it easier to benchmark and compare progress across countries. These ladders are built around the established JMP classification of facilities into improved and unimproved types, and they introduced additional criteria relating to the levels of services. Further, the ladders are primarily designed to track progress towards a basic level of drinking water. WASH indicators are selected for global monitoring of progress towards WASH related SDG targets.

The JMP (2019) classifies WASH facilities in the schools as being either improved or non-improved. The improved water sources include piped water, boreholes or tube wells, protected dug wells, protected springs and packaged or delivered water. Similarly, improved sanitation facilities include flush/pour toilets,

ventilated improved pit latrines, composting toilets and pit latrines with a slab or platform. The improved hygiene facilities include fixed or portable handwashing facilities including a sink with tap water, buckets with taps, tippy-taps and jugs, or basins designed for handwashing. Soap includes bar soap, liquid soap, powder detergent and soapy water but does not include ash, soil, sand or other handwashing agents.

On the other hand, unimproved water sources include unprotected wells, unprotected springs and surface water. The unimproved sanitation facility includes pit latrines without a slab or platform, hanging latrines and bucket latrines. Furthermore, the researcher classified facilities as unimproved if there were no separate sanitation facilities for boys and girls. Similarly, unimproved hygiene facilities included handwashing facilities without soap and running water at the water point.

Sample and Sampling Procedure

Sample Participants. In total, eight hundred participants participated, seven hundred sixty-eight of which were students for the quantitative data and thirty-two were students, teachers, and parents providing qualitative information. Among the 768 quantitative respondents, equal groups of 384 were selected from schools with improved and unimproved WASH facilities. The students were proportionally selected from the selected grades 6, 7, and 8 in both improved and unimproved schools. Equal groups of interviewees were selected from schools with and without improved WASH facilities (Table 2).

Table 2. *Sample Matrix*

School type	School	Quantitative	Qualitative				Total
		Students	Parents	Students	Head-teacher	Health-teacher	
Improved	2	384	8	4	2	2	400
Unimproved	2	384	8	4	2	2	400
Total	4	768	16	8	4	4	800

The different target groups: students, teachers, head-teachers, and parents, were selected to examine the research issues from intersubjective ontological and double-faced epistemological perspectives, which followed a pragmatic research paradigm including mixed methods.

Sampling Procedure. Initially, 768 students were chosen applying a stratified sampling procedure to obtain quantitative data from the selected basic level schools. Prior to the students' selection, the sample size was calculated applying the standard statistical formula: S= $\frac{\mathbf{z^2 \times p \times (1-p)}}{\mathbf{e^2}}$ (Cochran, 1977). The procedure which was used to compute the sample size from the entire population is presented below:

S= $\frac{\mathbf{z^2 \times p \times (1-p)}}{\mathbf{e^2}}$

Where,

S= population size,

Z= the standard normal deviation, set at 1.96 which corresponds to 95% confidence level,

P= population proportion (assumed to be 50% (0.5)

e= margin of error/acceptance range of error, generally we take margin of error as 5% (0.05).

Now, the Z score is determined based on the confidence level, the probability that the parameter depends on a specified range of values. The e margin of

error/acceptance level of error is a small amount allowed for in case of miscalculation or chance of circumstances.

Formula,

$$S=\frac{z^2\times p\times(1-p)}{e^2} \qquad S=\frac{1.96^2\times 0.5\times(1-0.5)}{(0.005)^2} \qquad S=\frac{3.8416\times 0.25}{0.0025}$$ S= 384.16= 384

So, as per the above calculation, the calculated sample size for the quantitative data is 384. The researcher set the sample size based on probability theory. Since this study has a heterogeneous sample, such as differentiated access to schools with improved and unimproved WASH facilities, this requires stratification. As a consequence, the researcher adjusted the design effect two (384×2) and made 768 the sample size to make a more representative sample and minimize the sampling error. Equal numbers of participants, 384 from each stratum of improved and unimproved school WASH facilities, were recruited. The students were proportionally selected from the selected grades 6, 7, and 8 in both improved and unimproved schools.

The mentioned qualitative participants were selected as critical informants for two reasons. First, this sampling procedure was used to access 'knowledgeable people', especially those with in-depth knowledge regarding WASH in schools, possibly by virtue of their professional role, power, access, networks, or experience (Ball, 1990; as cited in Cohen et al., 2007). Secondly, a good sample must be representative of the entire population. Ideally, it must provide complete information about the population from which the model has been drawn (Koul, 2009).

Research Tools

As the study followed a quantitative-dominant concurrent mixed method, it required both quantitative and qualitative information. To obtain both types of data, the researcher formulated quantitative and qualitative research tools. As tools for data elicitation, the structured questionnaire sheet, Key Informants Interview (KII)

guidelines, In-depth Interview (IDI) guidelines, and participant observation checklist were carefully prepared with the help of the supervisor to collect the required information. The researcher heavily used quantitative data throughout the research, whereas qualitative information took a supportive role to augment the quantitative findings or to differentiate between them. Moreover, qualitative results are used for cross-validation of the quantitative findings during the study. The researcher applied the face-to-face interview method in tools such as survey questionnaire, KIIs, and IDIs because the researcher can clarify ambiguous questions on the spot (Gillham, 2000). During the formulation of the research questionnaires, the other considerations, for instance question sequencing, layout and appearance, length, language, and introduction each received focus. The researcher revised the unclear, obscure questions and reworded complex items based on the reviewers' comments. These tools are briefly explained below.

Structured Questionnaire. Survey questionnaires were administrated to the students to assess their knowledge**,** attitudes, subjective-norms, self-efficacy, intention, and practices regarding WASH. At the same time, the students responded about WASH conditions at school too. They further responded concerning their health status and absence from school in the previous six months during the study period. In addition, they also responded about the types of diseases, frequency of infections, causes of school absenteeism, and educational achievement. The data was collected from the selected four schools in a single phase of the study. Both types: structured questionnaires for quantitative data and semi-structured/open-ended questionnaires for qualitative data were obtained for the study. The researcher applied these research tools to complement each other.

Key Informants Interviews (KIIs). The KIIs were performed to obtain first-hand, in-depth knowledge regarding WASH facilities and behaviours. The KIIs were conducted with the teachers (head teachers and health teachers) of the selected schools and parents of the selected students. They were selected based on their ability to be rich sources of information in WASH facilities, practices and their effects on students' health, school absenteeism, and educational achievements. The researcher carried out detailed interviews with teachers about WASH access at the school, and its association with students' health status, school absenteeism, and educational achievements. Furthermore, the interview focused on ongoing hygiene education, the activities of the school management committee regarding WASH-related issues, and engagement with other non-governmental organisations providing WASH infrastructure and education.

The parents were interviewed at their homes, whereas teachers were in the school, where it was more convenient to respond to the subject matter. The KIIs are the key sources for understanding how people perceive and interpret the world around them. The researcher regulated the interview to reveal existing knowledge that can be expressed in the form of answers and become accessible to interpretation.

In-depth Interviews (IDIs). The researcher carried out IDIs to determine students' health behaviour within schools. During the interview process, the students were asked about the problems they had been facing in the schools stemming from WASH deficiencies. They were interviewed regarding how the inadequate WASH facilities in the school impaired their health status, school regularity, and educational achievements, or how other subsidiary causes were embedded. The IDIs were also recorded on the mobile recorder with permission of the informants. The IDIs are key sources for understanding how people perceive, interpret, and respond to the issues

they face in their day-to-day activities. The researcher regulated the interview to reveal what exactly they faced within their school in terms of WASH deficiencies and sufficiency. Their responses based on experiences regarding school WASH facilities were accessible for interpretation.

Observation. It was conducted based on the accessibility and availability of safe drinking water, sanitation, and hygiene facilities in the school. The researcher further observed the number and conditions of latrines with MHM facilities in the schools. The researcher also assessed the handwashing point with running water and the availability of soap and students' handwashing behaviours in the schools. When available, the researcher collected the teacher-recorded rollcalls, as well as learning outcomes based on test scores from school records.

As a participant-observer, the researcher observed school WASH infrastructure and practises as per the research objective. They went about their normal activities and took notes on what takes place. While implementing the observation, a single observation was regulated because there is no ideal amount of time to observe (Merriam, 1998). As Marshall and Rossman (1995) said, the observational method was applied to check for non-verbal expression of feelings. The participant observation enabled the researcher to combine it with questionnaires and interviews to collect relatively objective firsthand information (Johnson & Turner, 2003). Based on the ideas of Merriam (1998) observation is a kind of triangulation and it has been applied in this study to substantiate the findings. In the same way, as Nation (1997) stated, the researcher studied the representations of behaviour rather than the behaviour itself.

Key Variables

The primary measures of effect include students' health status, school attendance/regularity, and educational achievements. The researcher used objective, unbiased measures of effect as much as was possible. In addition, the researcher applied subjective indicators to understand additional exposure factors and their effects on the mentioned variables. One potential type of bias considered in this dissertation is recall bias, where participants are likely to forget the correct response over time. Similarly, the reporting/response bias states that participants are likely to misrepresent the accurate response either to please the researcher with the correct answer or because the respondent does not want to relay the precise information. The challenges related to bias and subjectivity of measurement are discussed below.

Health Status. The researcher measured the students' health status based on sickness, which was assessed by self-reporting for causes in the six months previous to the study period. At the same time, the sorts of diseases that they caught, including causes of sickness and curative systems in health status, were all examined. In other words, the health status was assessed through students' responses on whether they had been sick by WASH-related diseases; diarrhea, cholera, shigellosis, salmonellosis, typhoid, or dysentery. For the cross-validation, the researcher obtained parental reports and school official records as well.

Regularity/Absence. Primarily, the student's absence was measured by checking the official attendance record. It was verified through students' self-reporting and parental reporting as well. It was performed because target students from grades 6, 7, and 8 and their parents could remember whether they had gone to school due to sickness or other causes. Such information was obtained objectively by asking about the six months previous to the study period. At least a day's absenteeism was

measured as absenteeism. If the student left school after half day, or even after a class, the student was not measured as absent. School records were accessed as authentic information, when contradiction was found among sources.

Educational Achievements. Educational achievements are represented by students' learning outcomes like grade GPA/test scores obtained in the summative evaluation of the grade. Initially, it was recorded from students' self-reporting and verified through the school authority records for grades 6 and 7 and EDCU for grade 8.

Reliability and Validity

Reliability and validity are the two main characteristics of the research tools. Koul (2010) stated that researchers should be highly aware of the reliability and validity of research tools while developing them. The former reveals whether the result is replicable, whilst the latter is associated with whether the means of measurement are accurate and that they measure what they are intended to measure. According to Nunan (1999), reliability is considered to mean consistency and dependability, and validity focuses on the trustworthiness, utility, and dependability of results. Indeed, the chosen methods provide consistent results, and they adequately measure the characteristics that they are looking at (Torrington, Hall & Taylor, 2008).

Based on the mentioned literature, the researcher concluded that consistency and accuracy of the data and findings are the main requirements of any research acquired from reliable instruments. In the same way, the quality and acceptability of the data and the conclusions of the study are other imperative characteristics, and validity yields these characteristics for any research. It is up to the researcher and research participants because they attempt to build reliability and validity into the different phases of the research, from data collection to data analysis and

interpretation. The data and instruments must be valid and reliable. Concerning this fact, the researcher applied the following miscellaneous procedures to make sure the research tools used in the study were accurate and reliable.

Validity

Validity concerns whether a piece of research is believable and authentic and evaluating what it claims to assess. Hammersley (1987) stated that an account is valid or true if it accurately represents those features of the phenomena, intended to describe or explain theories. According to Denscombe (1998) the use of multi-methods for examining one issue corroborates the research findings and increases the validity of the data. This fact is concerned with two main issues: whether the instruments used for measurement are accurate and whether they measure what they want to measure.

As Zohrabi (2013) presented the four procedures: (i) content validity, (ii) internal validity, (iii) utility criterion validity, and (iv) external validity, all these procedures were applied to validate the instruments and the data in the study.

Content Validity. This is a type of validity in which research tools and data were reviewed by the 'experts' Zohrabi (2013) and 'panel of experts' Bolarinwa (2015) before and after the pilot stage. Along with this, the researcher discarded the ineffective and non-functioning questions. The process of validating research tools through review is also called face validity (Ullah, Noor & Tariq, 2018).

Internal Validity. This validity was established employing several triangulations Merrian, (1998), for instance; (i) triangulation of data sources: students, head teachers, and health teachers, (ii) triangulation of methods: quantitative and qualitative methods, (iii) triangulation of theories: HBM and TPB. Zohrabi (2013) stated that internal validity minimises bias in the study through peer examinations and

members' checks. Regarding discrimination, the researcher used careful prompts during interviews, and followed a systematic approach in the thematic analysis which helped to eliminate biases. Another way of maximizing validity in the study was sharing and discussing the instruments with colleagues during the pilot stage and findings stage too. The researcher discussed those findings with the colleagues and especially with the supervisor.

Utility Criterion Validity. This inquires whether the evaluation work generates enough information regarding the effectiveness and appropriateness of the study. It was established by exploring attitudes, subjective-norms, self-efficacy, and intentions of student participants. It is an area that has been sufficiently explored so far. The findings add value to the theory and practice of students in terms of exploring attitudes, subjective-norms, self-efficacy, and intentions and their effect on students' health, regularity, and educational achievements.

External Validity. This argues that the qualitative research findings should be generalized to a theory rather than to a population (Bryman, 2004; Bolarinwa, 2015). In this study, the researcher enhanced external validity by selecting participants (head-teachers, health teachers, parents, and students). From the selection of more knowledgeable and experienced participants, the researcher obtained more authentic information regarding school WASH facilities and their effect on students' health status, school regularity, and educational achievements.

Reliability

Reliability deals with the consistency, dependability, and replicability (Nunan, 1999) of the research findings. Robson (2002) defined reliability as the extent to which a research project would produce the same or similar results to the original research if replicated using the same procedures and methods. Similarly, Lincoln and

Guba (1985) pointed out that it is better to think about the dependability and consistency of the data, instead of obtaining the same results. In the qualitative approach, achieving identical results is challenging because the data are in narrative and subjective form. In this regard, Marshall and Rossman (1999) and Seale (1999) argued that the absolute replication of qualitative studies is complicated to achieve since they reflected the realities in which they were collected and situations that are likely to change. In the same way, Henson et al. (2001) state that reliability refers to the results obtained with an evaluation instrument and not to the instrument itself.

In this study, the researcher ensured reliability for both the quantitative and qualitative measurements. For the quantitative part, the reliability of the instruments was established by using a reliability coefficient and Cronbach's alpha test. Furthermore, the researcher secured results by selecting a sample relevant to the constructs in question. In the qualitative stage, establishing reliability was not a straightforward task. However, the researcher made every effort to ensure that both measures and responses were reliable throughout the phase. For this, careful consideration was given to planning the interview so that probing and questioning had less impact on reliability. Furthermore, interviews were administrated carefully so as not to mislead respondents. It was carried out in a peaceful environment where interviewees felt comfortable to respond, and where other noises did not impact their opinions. Finally, the interviews were recorded and preserved with permission; therefore, the researcher ensured the possibility of reanalysis or data replication. This procedure boosted the internal reliability of the research tools, data, and findings.

Interviews are interpersonal, as they involve humans interacting with humans. In an interview, the researcher will inevitably influence the interviewee and, thereby,

the data (Cohen et al., 2011). As Silverman (1993) stated, the researcher carried out interviews in a structured form to maintain reliability.

Data Collection Procedures

This research was carried out during the period of January to March 2021 in four different schools of two districts: Dhanusha and Chitwan of Nepal. The total participants were 800, consisting of 768 for quantitative and 32 for qualitative data. As the research applied a causal comparative research design, each stratum of improved and unimproved schools had equal 400 respondents.

After finalizing the research tools and study area, the researcher visited the head of the EDCU in the study location. The researcher presented the purpose of the study and consulted with the EDCU members. Schools with improved and unimproved WASH facilities were selected in close consultation with the EDCU head. With the reference of the EDCU, the researcher visited school's authorities and explained the purpose of the ongoing research and criteria for the school selection. After obtaining the school officials' permission, the researcher observed schools' WASH facilities and finalized whether schools' WASH facilities were improved or unimproved based on the JMP 2018 WASH guidelines criteria.

Soon after, the researcher visited school staff and students to explain their role in this study. Moreover, the students were informed separately about the nature and purpose, pros and cons, and their roles and responsibilities in this study. The students were selected applying a stratified sampling procedure proportionally from each selected grade.

The preliminary phase of the data collection procedure involved establishing rapport with the participants (head-teachers, health teachers, parents, and students) in selected schools, in order to do the assignment carefully. At the same time, the

respondents were informed that their participation in the research was totally voluntary, and they had the right to cease their participation at any time if they felt discomfort.

To obtain responses to the questions freely, honestly, and sincerely, the researcher said that there is no right or wrong answers to these questions, and that the participants were free to answer however they preferred. Furthermore, the researcher acknowledged that their professional career would not be negatively affected as this research was only an exercise for research purposes and their responses would be kept strictly confidential. Before the interview, the researcher assured that none of them would face any distress or discomfort before, during, and after the process, as referred to by Sreejesh and Mohapatra (2014). Additionally, before assigning the task, the tools of each test used in the study were made clear. The head-teachers were also informed about the same procedures and administrated research tools. The researcher collected the entire inventory of data and thanked all of them, including the head teachers, health teachers, parents, and students, for their cooperation. The same procedure was applied in all schools.

The first data collection procedure, the structured questionnaire, was administered to the students. Students studying in grades 6, 7, and 8 of the basic level were listed separately based on sex. Then, the required students (male and female) were selected using a stratified random sampling procedure. The selected students were gathered and informed about the purpose of the study. Concurrently, the researcher administrated the questionnaire to them one by one in a separate classroom where they felt comfortable.

The second data collection procedure, the KIIs, was administered to the teachers (head-teachers and health teachers) and parents. The researcher administered

face-to-face interviews with the interviewees. Teachers were interviewed at the school, whereas parents participated at their homes. The researcher asked the selected students whether their parents could meet on that day after school time. After consultation with the selected students and their parents, the researcher visited parents at their house to administer the KIIs and also to observe the household's WASH facilities. Afterward, the researcher conducted face-to-face interviews with each participant where they feel comfortable responding; they were not compelled to respond to the questionnaire.

The third data collection tool, named IDI, was administrated to the students. They were interviewed at the school rooms separately where they would feel more comfortable responding to the questions. The KIIs and IDIs were recorded on the mobile recorder with permission of the informants, as Merriam (1998) emphasized that the researcher cannot observe the informants' feelings and thinking. The KIIs and IDIs were conducted at the school's premises and households directly with open-ended questions. Each interview in its entirety lasted about 30-50 minutes and was recorded in the mobile recorder with permission from the participants. The participants' observation was performed in the fourth data collection procedure in participating schools. While conducting observation, the researcher observed the WASH infrastructure of the schools and students' WASH behaviour. In this procedure, to observe the infrastructure, the researcher revealed his true identity and purpose to the schools' members and asked permission to attend. While recording the students' WASH behaviour, the researcher acted as a naturalistic observer. In this regard, McLeod (2015) stated that participant observation involves studying the spontaneous behaviour of students in their natural surroundings. At the same time, the researcher simply made records/notes of what he had seen, however the students

behaved. The researcher mentioned the schools' infrastructure and the student's behaviour in the already-drafted observation checklist as per the research requirements.

Data Analysis Procedures

As this research followed a mixed method approach, both quantitative and qualitative data were analysed in descriptive and thematic approaches, respectively (Creswell, 2014). The researcher further applied three sorts of statistical analysis procedures: univariate, bivariate, and multivariate analysis of the quantitative data (Singh, 2007). Research requires these sorts of analyses to explore the association between two variables and effects among more than two variables. Analogously, through multivariate analysis, the researcher found a pattern of effects of school WASH facilities, attitudes, subjective-norms, self-efficacy, and intention, as well as other socio-demographic variables such as age, sex, grade, ethnicity, and religion of the students, on health status, school regularity, and educational achievements. The qualitative data obtained in the form of KIIs and IDIs were analysed thematically using a qualitative data management software package.

Analysis of Quantitative Data

Initially, the researcher performed the univariate analysis to describe the percentage and frequency of sampled participants within several socio-demographic variables, such as age, sex, grade, ethnicity, and religion. A bivariate analysis was performed through chi-squared tests to show the association between variables. Additionally, the researcher performed multivariate analysis through multilevel modeling/logistic regression in which the outcome variable is hypothesized to be influenced simultaneously by various factors from different levels.

The dependent variables of this study were health status; (sick or not), school regularity (yes or no), and educational achievement in terms of learning outcomes obtained scores/GPA B and above or C and below. All these dependent variables were categorized into two groups. So, binary logistic regression with multilevel modeling was performed to examine the net effect of school WASH facilities on students' health status, school regularity, and educational achievement.

Before going to the analysis, first, the researcher edited the data. All collected raw data were edited to detect errors and omissions and to correct these as much as possible. This was done to assure that the collected data were accurate and consistent. In other words, the term editing implies the security of the completed interview in this research.

Secondly, in the data coding, the researcher proceeded to assign numerical and other symbolic values to put responses into several categories or classes. This process reduced several replies to a few classes, which assisted the researcher in performing efficient analysis.

Thirdly, after editing and coding the large volume of raw data, the data was classified into different homogeneous groups to obtain meaningful relationships. The researcher ranked respondents based on their common characteristics, and they were placed in one class. In this way, the entire data was divided into several groups.

As above mentioned, univariate, bivariate, and multivariate analysis techniques were applied for the quantitative data. First, univariate analysis was applied to understand the distribution of values for a single variable. This analysis contains only one variable and doesn't deal with cause or effect relationships. The researcher generated the frequency distribution tables to summarise how often different values occur, allowing for quick observation of the most frequent

variables. Secondly, bivariate analysis was performed to investigate the association between the variables. The data were analyzed using chi-square tests to see whether two groups of data are associated with each other. The analysis examined the relationship between schools having and not having improved WASH facilities on students' health status, school regularity, and educational achievements, studying whether a relationship exists between them. The variables were further assessed controlling for characteristics such as age, sex, grade, caste, and religion.

Thirdly, multivariate/logistic regression analysis was used to describe the effect among more than two independent variables on the dependent variables. In doing so, the researcher applied four sorts of modeling. The first level model was computed to illustrate the effect of school WASH facilities on students' health status, school regularity, and educational achievements. In the second model, the researcher assessed the effect of school WASH facilities on health status, school regularity, and educational achievements, adjusting for students' attitude, subjective-norms, and self-efficacy. The third model modeled the effect of school WASH facilities, including students' attitude, subjective-norms, self-efficacy, and intention on school WASH on health status, school regularity, and educational achievements. Finally, in the fourth model, the researcher assessed the effect of school WASH facilities on health status, school regularity, and educational achievements, while adjusting for all variables: students' attitude, subjective-norms, self-efficacy, intention, age, sex, grade, and caste.

Students' attitude, subjective-norms, self-efficacy, and intention variables adopted from TPB and HBM were also measured by asking four thematic questions, with response options dictated by a 5-point Likert scale. The 38 questions directly addressed attitude, subjective-norms, self-efficacy, and intention relating to WASH

services at school. Answers to these items were rated from 1 (strongly disagree) to 5 (strongly agree).

Initially, the 5-point Likert scale data were computed by separate mean score of four variables. The variables included: attitude about school WASH, self-efficacy, subjective-norms, and intention; the variables were dichotomous. The variables were categorised into two strata based on their mean score.

1. Attitude (0 to 3.80 = 1, Average or below) and (3.81 and up = 2, above average)
2. Self-efficacy (0 to 4.31 = 1, Average or below) and (4.32 and up = 2, above average)
3. Subjective-norms (0 to 3.87 = 1, Average or below) and (3.88 and up = 2, above average)
4. Intention (0 to 4.39 = 1, Average or below) and (4.40 and up = 2, above average).

As presented above, the researcher assessed students' health status, school regularity, and educational achievements through their school WASH situation, age, sex, grade, caste, religion, attitude, self-efficacy, subjective-norms, and intention related to WASH behaviour. Furthermore, the analysis has been presented based on the objectives. The results have been discussed based on quantitative objectives. The researcher referenced the final qualitative objective with the quantitative to see if they substantiated each other.

Analysis of Qualitative Data

The study used the thematic approach inductively to analyze the responses from KIIs and IDIs aiming to identify, research, and report patterns within the data (Nowell et al., 2017). The Dedoose Version 9.0.17, a web application for managing, analyzing, and presenting qualitative data was used to code, and make categories and

themes of the transcribed interviews. The qualitative data analysis process involved carefully listening to recorded information in order to thematically analyze it. Initially, the researcher carefully listened to each participant's recorded information and transcribed it into English. Afterwards, the transcripts were imported in Dedoose. Soon after, each response was coded one by one and categorized in the software. In this step, the researcher added the memos written during the field study. The researcher also created themes within the software. Finally, the data was exported to the excel sheet with memos, and a final theme was created. There was a total of 40 codes, 14 categories, and three themes in this qualitative analysis (Table 3). Then the data was analysed thematically, referring to memos and transcripts as needed.

Overall, qualitative research findings from the students, teachers, and parents were analysed with respect to students' health status, school regularity, and educational achievements with improved and unimproved school WASH facilities. The qualitative research was concerned with the students', parents' and teachers' understanding, experiences and perceptions towards school WASH facilities, and their association including the effects on students' health status, school regularity, and educational achievements.

The interview was administrated based on the interview protocol, which included a brief description of the research and a clear set of instructions for collecting qualitative data to parents, teachers, and students. As Baumgartner (2020) stated, data analysis in qualitative research is recursive and dynamic; the researcher collected data by way of an interview protocol with the participants. The participants were not offered any remunerations such as money or any goods in return for participation in the study (Landau et al., 2004). The researcher carefully checked all the records of the interviews after the completion of the interviews. Initially, the researcher transcribed all the collected data and carefully inspected it in several rounds to reduce the duplications, missing responses, and neatness. It is a process that

involves arranging and reviewing transcripts of interviews systematically to build up the researcher's understanding of the phenomena under research (Ritchey, 2008).

Table 3. *Summary of Making Codes, Categories, and Themes*

Codes	Categories	Themes
Lack of hygiene materials Lack of specific hygiene stations Stink on toilet Not water access to all and lack of sanitation services Lack of sanitation services	Poor School WASH facilities	Student Illness
I have never used school toilets.	I do not prefer to use the school toilet.	
Drink water without purification Contaminated water Unavailability of water at toilets	Water scares and contamination	
Diarrhoea Fever Eye infections Seasonal infections Skin disease	Illness	Absenteeism
Household core/responsibility Social responsibility Participation in the religious function Fear of punishment by a teacher Fear of harassment Over bleeding and pain	Household and social responsibility Religious task Fear of punishment Menstruation	
Stink on toilet lack of sanitation services I have never used school toilets. Drink water without purification Unavailability of water at toilets	Poor School WASH facilities	
Stink on toilet lack of sanitation services I have never used school toilets. Drink water without purification Lack of toilet cleanliness Unavailability of water at toilets	Poor School WASH facilities	Educational achievement
Illness	Illness	
Absenteeism	Absenteeism	
Lack of MHM facilities and equipment Poor WASH facilities Menstruation problems (teasing/fear/hesitation) MHM facilities and equipment (water, hanging pin, soap, towel appropriate door and light, No separate room for MHM No luck system at toilet	Menstruation problems	

Triangulation/Data Authentication Process

Since the researcher analysed both quantitative and qualitative data independently, the final analysis was made through triangulation. The researcher performed triangulation to show the accuracy of the data. To make data more transparent, the researcher transferred the results from the quantitative data by creating narrative descriptions based on the descriptive tables and compared data with qualitative themes, as qualitative findings were used to augment the quantitative results. In this section, the researcher merged the study's findings with the results from the quantitative research to show the associations and effects of school WASH facilities on students' health status, school regularity, and educational achievement.

According to Da Vinic (2009), there are four types of triangulations: i) data triangulation, ii) investigator triangulation, iii) methodological triangulation, and iv) theory triangulation. In this study the researcher applied three sorts of triangulation: data source triangulation, method triangulation, and theory triangulation, to make the research findings more reliable and authentic.

First, for the data source triangulation, the researcher collected data from different participants; students, head-teachers, health teachers, parents, and through participant observations, and then combined or compared them with each other to increase the validity of the findings. Secondly, for the methodological triangulation, the researcher used both quantitative and qualitative methods in a single study. Thirdly, theory triangulation includes TPB and HBM, which are applied to discuss students' attitudes, self-efficacy, subjective-norms, and intentions on WASH facilities in the schools. In other words, only four aspects of TPB and HBM: attitudes, self-efficacy, subjective-norms, and intentions, were applied and compared with research findings in order to determine whether it supports the theory or contrasts with it.

The researcher applied triangulation to assist in increasing the credibility and validity of the study. Moreover, as Denzin (1970) stated, the researcher did triangulation to overcome the intrinsic bias of a single method and avoid errors by cross-checking the data and findings. This process strengthened the research findings.

Ethical Considerations

Initially, the Graduate School of Education (GSE) of Tribhuvan University, Nepal, approved the study. Furthermore, the researcher obtained ethical approval from the Nepal Health Research Council (NHRC), Nepal, and 85412020 PhD. The researcher fully abided by the following ethical guidelines before, during, and after the study:

Informed Consent

Before the data collection, the researcher fully informed the participants and the organizations (schools) participating in the research. The researcher took the processes of seeking approval and informing participants about the study very seriously. Cohen et al. (2007) pointed out the need to protect and respect the rights of the respondent to self-determination to participate or withdraw from the research process, and accordingly, the researcher used an informed consent letter explaining the purposes of the research so that the participants could decide whether or not to participate in the research. Voluntary consent to participate in a study is a central principle in research ethics. The researcher requested voluntary participation from the participants, and those who participated did so free from coercion. They were free and acknowledged that they could withdraw their participation at any time without negatively impacting their involvement in future services and relationships with any of the researchers. Participants had the right to leave research at any time; therefore,

no pressure was kept on those who were not willing to continue; however, no participants quit during the study.

At the outset, for the quantitative data, the researcher made face-to-face contact with the academic officials. Later on, the researcher visited head-teachers of all the schools and identified them as relevant for the study, requesting their participation. This included schools exclusively for children with basic level grades; 6, 7, and 8. The researcher explained the nature of the research, asked for consent to proceed with the study, and administrated the questionnaires to the students in the school. The questionnaire contained an introductory page including information about the nature of the research, reassuring anonymity and confidentiality of the participants and their data, as well as their right to withdraw at any time. The participants were asked to tick a 'yes' box stating their consent ahead of the question section.

A similar procedure was applied in the qualitative phase while taking interviews with parents, teachers, and students. The researcher individually asked about their willingness to participate in research and informed them about the anonymity, confidentiality, and right to withdraw at any point. The researcher obtained verbal consent with all participants prior to administrating interviews. The researcher recorded each interview in the recording devices in order to not lose the data and to retain the possibility of reanalysis. Furthermore, the researcher took verbal consent for recording the qualitative interview before starting each interview session.

Anonymity and Confidentiality

Participants' right to privacy involves two basic principles: anonymity and confidentiality. Cohen et al. (2011) argue that the essence of anonymity is that information provided by the participants should in no way reveal their identity. The participants were provided assurance and information about confidentiality; they had

the option to provide their names or other identifiable details while completing the questionnaires. To maintain anonymity and confidence, the researcher ensured that their identity wouldn't be published in the study and that researcher was the only person to access the raw data.

The only characteristic that the researcher identified was the postcode of the school on the questionnaire for data analysis purpose so that the type of the school and student participants could then be identified. During the analysis, the researcher mentioned neither the names of the participants nor the schools.

To protect a participant's right to privacy, the researcher followed the promise of confidentiality: not disclosing information from a participant in any way that might identify the individual or that might enable the individual to be traced (Cohen et al., 2011). The interviews were administered in a private room. The participants were informed that the interviews were going to be recorded and then transcribed.

Do no Harm and Right to Information

The researcher was working in exceptional circumstances and therefore had time to reflect on his actions and gain a deeper understanding of the study. It was critical during COVID-19 to consider when and how to do studies or interviews during the pandemic. The researcher ensured that the activities that would be done during the study would not harm the health and safety of participants. The researcher thoroughly followed the GoN safety regulations; maintaining physical distance, wearing a mask, and using sanitiser frequently. The researcher strongly communicated with the school authority to obtain the data that the researcher school records were “need to know” instead of “nice to know.” Furthermore, the researcher paused non-essential study activities during two days of WASH-related theory and practical classes at study schools. Besides this, the researcher maintained consistent

and transparent communication with school authorities using Short Message Service (SMS) and phone calls to give updates and further clarification about obtained information, if necessary.

The researcher was fully aware of the potential for informants' physical, psychological, and legal harm and his responsibility for eliminating them in any way whatsoever. Participants had the right to know the outcomes of the research since they are an integral part of the research. So, the researcher encouraged them to view the research findings after the completion of the study.

The data obtained from the research is kept safe in a place where the researcher can maintain the confidentiality of information. The researcher can utilise the data for future follow-up studies, as Cohen et al. (2011) stated.

CHAPTER IV

Analysis and Interpretation

This chapter presents the quantitative findings followed by the qualitative findings. These findings are grounded in the research objectives that guided the study. The researcher analysed the quantitative data to show the association and assess the effect of WASH facilities on students' health status, school regularity, and educational achievements. Concurrently, the researcher analysed qualitative data to explore teachers', students', and parents' views of health status, school regularity, and educational achievements of students with improved and unimproved WASH facilities in schools. The qualitative findings were used to augment the quantitative results or to differentiate them from each other.

Basic Characteristics of Respondents

A total of 768 students participated, with equal proportions in schools with and without improved WASH facilities. Table 4 shows that the majority (82%) were aged 10-14, and (47%) were from schools where interventions had occurred. Comparatively, more respondents were female, and less were from schools with unimproved WASH facilities. Respondents fairly equally represented grades six to eight. There were higher respondents of Brahmin/Chhetri-Hill (29%) than Brahmin/Chhetri-Terai (27%), Dalit (19%), Janajati (16%), and other castes (9%). The improved schools had a quarter of Brahmin/Chhetri Hill and less (2%) represented the other caste respondents. The highest percentage (20%) Brahmin/Chhetri Terai and a few (4%) Brahmin/Chhetri Hill respondents were found in unimproved school WASH facilities. The overwhelming majority (82%) were Hindu, a number represented fairly equally in both schools with improved and unimproved WASH facilities (Table 4). In this study, non-Hindu participants were

Buddhist, Christian, and Muslim. Table 4 gives the details of the background characteristics of the respondents.

Table 4. *Background Characteristics of the Students'*

Variables	School WASH Facilities					
	Improved		Unimproved		Total	
	N	%	N	%	N=768	100%
Age group						
10-14	360	46.9	273	35.5	633	82.4
15-19	24	3.1	111	14.5	135	17.6
Sex						
Male	190	24.7	170	22.1	360	46.9
Female	194	25.3	214	27.9	214	53.1
Grade/Class						
Grade six	183	23.8	49	6.4	232	30.2
Grade seven	117	15.2	135	17.6	252	32.8
Grade eight	84	10.9	200	26.0	284	37.0
Caste/Ethnicity						
Brahmin/Chhetri-Hill	190	24.7	34	4.4	224	29.2
Brahmin/Chhetri-Terai	54	7.0	152	19.8	206	26.8
Janajati	73	9.5	52	6.8	125	16.3
Dalit	49	6.4	95	12.4	144	18.8
Other caste	18	2.3	51	6.6	69	9.0
Religion						
Non-Hindu	73	9.5	65	8.5	138	18.0
Hindu	311	40.5	319	41.5	630	82.0
Total	**384**	**50.0**	**384**	**50.0**	**768**	**100**

Sources of Drinking Water in School

Generally, four types of sources for drinking water at schools were reported by students. Piped/tapped water was a common source with 68%, whilst tube well/hand pump was a minor source (28%) of drinking water at schools. The piped/tapped water was found as a higher source of drinking water in both types of schools: improved WASH (81%) and unimproved WASH (54%). The tube well/hand pump was the least-used source of drinking water in schools, which students in unimproved schools use nearly three times as much (44%) than those in improved schools (12%).

Overall, the respondents knew five types of water purification methods. Among them, boiling was the most popular purification method among students with a proportion of 74%, followed by filtration 65%, SODIS/Ultraviolet infection 32%, Chlorination 19%, not knowing (11%), and very few (2%) reported other methods (Bio-san technology). Boiling was the most recognised water purification method in both schools, consisting of 77% in improved and 70% in unimproved schools. Simultaneously, filtration was the second most-known water purification technique; the proportion for improved schools was higher (72%) than unimproved schools (58%).

When asked, "what is the importance of water purification", more than three-fourths (76%) of respondents understood "it kills germs", more than half (54%) said "safe for drinking", and less 10% revealed, "it makes water tasty". Respondents from both schools reported water purification kills germs, with 79% of students in improved schools and 73% in unimproved schools reporting this. In improved schools, 59% reported that purification is important for safe drinking, while this response was 10 percentage points lower in unimproved schools (49%). Nearly double (11%) of respondents from unimproved schools compared to improved (6%) schools responded that they do not know the importance of water purification. Table 5 presents the different sources of drinking water at schools.

Table 5. *Source of Drinking Water in School*

Variables		School WASH Situation					
		Improved		Unimproved		Total	
		N	%	N	%	N	%
Source of drinking water at school*	Deep-boring	166	43.2	126	32.8	292	38.0
	Tube well/hand pump	47	12.2	171	44.5	218	28.4
	Bottle/jar water	129	33.6	97	25.3	226	29.4
	Pipe/tap water	313	81.5	206	53.6	519	67.6
Water purification methods that you know*	Filtration	275	71.6	224	58.3	499	65.0
	Boiling	297	77.3	270	70.3	567	73.8
	Chlorination	94	24.5	50	13.0	144	18.8
	SODIS	163	42.4	82	21.3	245	31.9
	Others	5	1.3	8	2.1	13	1.7
	Do not know	26	6.8	58	15.1	84	10.9
Importance of water purification*	It kills the germs	303	79.1	280	72.9	583	76.0
	Safe for drinking	228	59.5	190	49.5	418	54.5
	Protect from diarrhoeal infection	210	54.8	134	34.9	344	44.9
	It makes testy	34	8.9	44	11.5	78	10.2
	Do not know	25	6.5	60	15.6	85	11.1
Total		384	100.0	384	100.0	768	100.0

*Multiple responses

Knowledge on Proper Disposal of Excreta

The respondents of this study revealed four core reasons for the proper disposal of human excreta in the proper places instead of OD. Among the reasons, to be clean carried the highest proportion (81%) compared to protecting from water and soil pollution (66%) and protecting from infection (50%). Cleanliness was the highest proportion (83%) in improved and was (78%) in unimproved schools. In a similar

vein, the reason to protect from water and soil pollution was of equal proportion (66%) in both types of schools.

Of the total, 88% of respondents answered stating the cleanliness of waste disposal is important for health purposes, more than half (52%) said it is important for smell, and few (13%) mentioned its importance in maintaining the family status in community in both type of schools. Nearly all (90%) and the majority (85%) of students from improved and unimproved schools, respectively, valued anal cleaning for health purposes. The improved proportion was higher (18%) than unimproved (12%). The data depicts the importance of anal cleaning to maintain family status in the community.

In response to "what are the anal cleaning materials", nearly all (90%) of respondents said water; the proportion in improved schools was high (95%) compared to unimproved schools (86%). Toothpaste was the most-used teeth cleaning material in both schools; the proportion was higher (90%) in improved compared to unimproved schools (81%). Similarly, soap and water were widely used bathing materials; 97% in improved and 91% in unimproved schools. The details of the data related to the knowledge of proper disposal of waste are presented in the table below (Table 6).

Table 6. *Knowledge on Sanitation*

Variables		School WASH Situation					
		Improved		Unimproved		Total	
		N	%	N	%	N	%
Reasons for human faces disposed of properly*	To be clean	320	83.3	299	77.9	619	80.6
	To protect water & soil pollution	218	56.8	166	43.2	384	50.0
	To Protect environment from pollution	254	66.1	254	66.1	508	66.1
	To be free from bad smell	1	0.3			1	0.1
	Do not know	3	0.8	20	5.2	23	3.0
Importance of cleanliness of anas*	Health purpose	347	90.4	327	85.2	674	87.8
	Smell purpose	184	47.9	214	55.7	398	51.8
	Status in family/community.	41	10.7	61	15.9	102	13.3
	Not good to be not clean	86	22.4	99	25.8	185	24.1
	Other			2	0.5	2	0.3
Anal cleaning material	Water	365	95.1	329	85.7	694	90.4
	Paper/leaf (green/dry)	7	1.8	27	7.0	35	4.5
	Do not do anything	11	2.9	28	7.3	39	5.0
	Other (soap)	1	0.3			1	0.1
Teeth cleaning materials	Tooth paste and water	347	90.4	313	81.5	660	85.9
	Herbal plant and water	37	9.6	52	13.5	89	11.6
	Water only	31	8.1	67	17.4	98	12.8
	Other			1	0.3	1	0.1
Bathing materials	Soap and water	372	96.9	348	90.6	720	93.8
	Water only	12	3.1	36	9.4	48	6.2
Total		384	100.0	384	100.0	768	100.0

Knowledge on Hygiene

In general, the respondents indicated seven appropriate times for handwashing. Among them, before eating and after using the toilet were most popular with proportions of 79% and 78%, respectively. Handwashing before eating and after using the toilet were common in improved schools with proportions of 85% and 83%. Similarly, handwashing before eating meals and after using the toilet were answered

by 74% and 70% in unimproved schools, respectively. Following this, one-third responded that “whenever they look dirty” was the appropriate time for handwashing, an answer with a higher proportion in improved schools (42%) than unimproved (24%).

The respondents of the study mainly presented four reasons for the importance of handwashing. To reduce the chances of getting infectious diseases was a popular response (89%). Nearly all (92%) respondents from improved schools accepted handwashing as important for reducing the chances of getting infections from diseases, and the majority (81%) from unimproved schools also accepted this importance. Of the total, most (60%) of the respondents revealed its importance for reducing the chances of getting diarrhoeal disease; this proportion (60%) was higher in unimproved schools compared to improved (57%). A quarter of respondents said handwashing is important to reduce stomachache from religious beliefs in which improved schools had a higher proportion (31%) compared to the unimproved ones (20%).

Eating fresh, washed fruits, and vegetables was the most popular hygiene-maintaining behaviour reported by (78%), followed by use of clean toilet (66%), drinking clean and purified water (62%), washing hands before and after using the toilet (61%), whilst a few (16%) wash hands after using the toilet. All hygiene maintaining behaviour has a higher proportion in improved schools compared to unimproved WASH facilities at school, while only 0.1% of respondents in unimproved schools responded “other.” Table 7 delineates the data related to the knowledge on hygiene.

Table 7. *Knowledge on Hygiene*

Variables		School WASH Situation					
		Improved		Unimproved		Total	
		N	%	N	%	N	%
Appropriate handwashing time	After touching garbage & animal	283	73.7	256	66.7	539	70.2
	After coughing & sneezing	226	58.9	196	51.0	422	54.9
	Whenever they look dirty	163	42.4	94	24.5	257	33.5
	Before and after contact of ill person	224	58.3	121	31.5	345	44.9
	After using toilets	319	83.1	270	70.3	589	76.7
	Before preparing food	288	75.0	204	53.1	492	64.1
	Before eating	326	84.9	283	73.7	609	79.3
Important of handwashing with soap and water*	To reduce the chances of getting diarrhoea	220	57.3	232	60.4	452	58.9
	To reduce the chances of getting other infection	354	92.2	313	81.5	667	86.8
	Keep hands clean	234	60.9	215	56.0	449	58.5
	To reduce stomachache ache from religious beliefs	119	31.0	76	19.8	195	25.4
Hygiene maintains to be healthy*	Eating fresh, washed fruits and vegetables	312	81.2	269	75.3	601	78.3
	Eating non-contaminated and unpolished food	194	50.5	167	43.5	361	47.0
	Using clean toilet	263	68.5	242	63.0	505	65.8
	Drinking clean and purified water	249	64.8	228	59.4	477	62.1
	Washing hands after playing	222	57.8	188	49.0	410	53.4
	Washing hands before and after eating	241	62.8	225	58.6	466	60.7
	Handwashing after the use of the toilet	82	21.4	42	10.9	124	16.1
	Other			1	0.3	1	0.1
Total		384	100.0	384	100.0	768	100.0

*Multiple responses

Measures of Attitude on Drinking Water

The researcher asked four questions to the students to measure their attitude towards the water at their school. Overall, more than two-fifths (42%) of respondents strongly agreed that drinking water is potable at school, whilst a quarter was neutral. Nearly six in ten (59%) respondents from improved schools strongly decided that their school had potable drinking water, while less than three in ten (27%) were neutral in unimproved schools. Overall, about one-third (32%) of respondents strongly agreed that water points at schools are accessible to all students (children with physical and visual deficiencies, including small children). In comparison, about a quarter (24%) was neutral about this point. Among the respondents who strongly agreed, 36% were from improved, and 30% were from unimproved schools. Among the neutral, more than a quarter (27%) and two in ten were from unimproved and improved schools, respectively.

These results show that nearly two-thirds of the respondents strongly agreed that water purification is essential before drinking. Simultaneously, a higher proportion (68%) of respondents in improved schools articulated that water purification before drinking is important, compared to those in unimproved schools (60%). The strongly disagree ratio was twice as high (12%) in unimproved schools compared to improved (6%) schools. More than two-fifths (42%) of respondents answered that the water in their school is sufficient for drinking, and other purposes, whilst few (9%) strongly disagreed. The strongly disagree proportion was lower (41%) in unimproved schools compared to improved (43%). In contrast, the proportion of students who answered that the water in their school is sufficient for drinking and other purposes was double (18%) in unimproved than improved (9%) schools. Just two-fifth of respondents responded to this question neutrally in

unimproved schools, compared to 16% in improved. Table 8 clearly presents the data related to the attitudes on drinking water.

Table 8. *Respondents' Attitude on Drinking Water*

Variables		School WASH Situation					
		Improved		Unimproved		Total	
		N	%	N	%	N	%
My school's drinking water is potable	Strongly disagree	18	4.7	65	16.9	83	10.8
	Disagree	4	1.0	18	4.7	22	2.9
	Neutral	73	19.0	116	30.2	189	24.6
	Agree	67	17.4	83	21.6	150	19.5
	Strongly agree	222	57.8	102	26.6	324	42.2
My school's drinking water is accessible to all students (physically & visually disable and small children)	Strongly disagree	47	12.2	43	11.2	90	11.7
	Disagree	47	12.2	69	18.0	116	15.1
	Neutral	77	20.1	105	27.3	182	23.7
	Agree	74	19.3	57	14.8	131	17.1
	Strongly agree	139	36.2	110	28.6	249	32.4
Do water purification is essential before drinking	Strongly disagree	25	6.5	45	11.7	70	9.1
	Disagree	6	1.6	23	6.0	29	3.8
	Neutral	29	7.6	22	5.7	51	6.6
	Agree	62	16.1	64	16.7	126	16.4
	Strongly agree	262	68.2	230	59.9	492	64.1
Sufficient water for drinking and other purposes	Strongly disagree	22	5.7	46	12.0	68	8.9
	Disagree	14	3.6	23	6.0	37	4.8
	Neutral	61	15.9	76	19.8	137	17.8
	Agree	120	31.2	83	21.6	203	26.4
	Strongly agree	167	43.5	156	40.6	323	42.1
Total		384	100.0	384	100.0	768	100.0

Measures of Attitude on Sanitation

Table 9 depicts the results of a study in which eight questions were asked about sanitation services at school to assess students' attitudes on sanitation. Most of the respondents (67%) agreed that the school had sufficient toilets, whereas one in five disagreed (20%) and 13% of them responded neutrally. About three-fourths

(78%) of respondents from improved schools agreed that they had adequate toilets at school; a higher proportion than in unimproved schools (55%). However, the proportion who disagreed was nearly three times higher (30%) in unimproved than improved schools (11%). The neutral responses were the least frequent, with a difference of only four percentage points; the proportions of the two groups were 15% and 11% in unimproved and improved schools, respectively.

Overall, most of the respondents (69%) said schools' toilets are useable; 51% of students in unimproved and 67% in improved schools answered this way. Less than half (48%) of girls feel comfortable using school toilets during their menstruation period, and the proportion was more than three times higher (43%) in improved than unimproved schools (14%). In response to "my school has gender-friendly sanitation facilities", the majority (76%) of respondents disagreed in total, and this proportion was higher in unimproved (70%) compared to improved schools (62%). More than two-thirds (80%) of the respondents agreed that their schools' toilets were clean, with a higher proportion of students in improved (96%) compared to unimproved schools (74%). Most (64%) of the respondents in both schools strongly agreed that human feces and excreta should be disposed of in separate places instead of being disposed of openly, with difference of only 6 percentage points between improved schools (67%) and unimproved schools (61%).

In total, the majority (85%) of respondents agreed that they should wash their hands with water and soap after using toilets, with just 12 percentage points between improved (91%) and unimproved schools (79%). In both schools, the majority (82%) of respondents agreed to wash their anus after using toilets, with just 18 percentage points between improved (91%) and unimproved schools (73%). The details have been given in the below (Table 9).

Table 9. *Respondents' Attitude on Sanitation*

Variables		School WASH Situation					
		Improved		Unimproved		Total	
		N	%	N	%	N	%
My school has separate and sufficient toilets for boys and girls	Strongly disagree	32	8.3	68	17.7	100	13.0
	Disagree	9	2.3	47	12.2	56	7.3
	Neutral	43	11.2	57	14.8	100	13.0
	Agree	62	16.1	43	11.2	105	13.7
	Strongly agree	238	62.0	169	44.0	407	53.0
My schools' toilets are useable	Strongly disagree	37	9.6	78	20.3	115	15.0
	Disagree	24	6.2	47	12.2	71	9.2
	Neutral	65	16.9	65	16.9	130	16.9
	Agree	124	32.3	72	18.8	196	25.5
	Strongly agree	134	34.9	122	31.8	256	33.3
I feel comfortable using the school toilet during menstruation period (Girls Only)	Strongly disagree	21	10.8	75	35.0	96	23.5
	Disagree	29	14.9	22	10.3	51	12.5
	Neutral	15	7.7	49	22.9	64	15.7
	Agree	45	23.2	37	17.3	82	20.1
	Strongly agree	84	43.3	31	14.5	115	28.2
My school has separate toilets for girls and differently able students	Strongly disagree	175	45.6	208	54.2	383	49.9
	Disagree	62	16.1	61	15.9	123	16.0
	Neutral	39	10.2	30	7.8	69	9.0
	Agree	30	7.8	30	7.8	60	7.8
	Strongly agree	78	20.3	55	14.3	133	17.3
My school toilets are clean	Strongly disagree	19	4.9	41	10.7	60	7.8
	Disagree	13	3.4	14	3.6	27	3.5
	Neutral	22	5.7	43	11.2	65	8.5
	Agree	49	12.8	66	17.2	115	15.0
	Strongly agree	281	73.2	220	57.3	501	65.2
Human faces and excreta should be disposed of in separate places instead of left openly in nature	Strongly disagree	35	9.1	39	10.2	74	9.6
	Disagree	16	4.2	24	6.2	40	5.2
	Neutral	34	8.9	42	10.9	76	9.9
	Agree	42	10.9	45	11.7	87	11.3
	Strongly agree	257	66.9	234	60.9	491	63.9
Hands should be properly washed with water and soap after using toilets	Strongly disagree	12	3.1	42	10.9	54	7.0
	Disagree	7	1.8	7	1.8	14	1.8
	Neutral	14	3.6	31	8.1	45	5.9
	Agree	29	7.6	57	14.8	86	11.2
	Strongly agree	322	83.9	247	64.3	569	74.1
I think it is essential to wash annual after using a toilet	Strongly disagree	15	3.9	54	14.1	69	9.0
	Disagree	3	.8	11	2.9	14	1.8
	Neutral	18	4.7	38	9.9	56	7.3
	Agree	53	13.8	63	16.4	116	15.1
	Strongly agree	295	76.8	218	56.8	513	66.8
Total		384	100.0	384	100.0	768	100.0

Respondents' Attitude towards Hygiene

The researcher asked six questions to measure the students' attitude on hygiene. Of the total, nearly three in five (59%) agreed that their school had an excellent handwashing station with soap and water; this proportion was 72% in improved schools, and 46% in unimproved schools. The majority (58%) of the respondents agreed that their school's handwashing stations were accessible to all students, including physically and visually disabled children and small children. Among them, the proportion in unimproved schools was lower (51%) than that in improved schools (65%). In response to the statement "we may catch infectious diseases if we do not wash hands properly with soap and water", the majority (79%) of respondents agreed, with a higher proportion of agreement in improved schools (86%) compared to the unimproved schools (72%).

More than three-fourths (77%) of respondents agreed that handwashing should be done before eating and after using the toilet, with just a 1 percentage point difference between improved (77%) and unimproved schools (76%). Two-thirds and more than half (52%) of students from improved and unimproved schools, respectively, stated that their school properly managed garbage. Conversely, in response to the statement "my school has proper MHM facilities," a higher proportion of students in unimproved schools (43%) disagreed compared to the improved schools (36%). Further, nearly three in ten respondents (29%) from unimproved schools and slightly more than two in five (21%) from improved schools answered neutrally. Table 10 clearly shows the data related to the respondents' attitudes on hygiene.

Table 10. *Respondents' Attitude towards Hygiene*

Variables		School WASH Situation					
		Improved		Unimproved		Total	
		N	%	N	%	N	%
My school has a good handwashing station with water and soap	Strongly disagree	42	10.9	109	28.4	151	19.7
	Disagree	14	3.6	41	10.7	55	7.2
	Neutral	53	13.8	58	15.1	111	14.5
	Agree	70	18.2	71	18.5	141	18.4
	Strongly agree	205	53.4	105	27.3	310	40.4
My school has an accessible handwashing station (with running water and soap) for all students	Strongly disagree	52	13.5	52	13.5	104	13.5
	Disagree	33	8.6	89	23.2	122	15.9
	Neutral	50	13.0	46	12.0	96	12.5
	Agree	81	21.1	73	19.0	154	20.1
	Strongly agree	168	43.8	124	32.3	292	38.0
May catch infectious diseases if we do not wash hands properly with soap and water	Strongly disagree	23	6.0	43	11.2	66	8.6
	Disagree	12	3.1	30	7.8	42	5.5
	Neutral	19	4.9	33	8.6	52	6.8
	Agree	34	8.9	71	18.5	105	13.7
	Strongly agree	296	77.1	207	53.9	503	65.5
Most appropriate time for handwashing is before eating and after using toilet	Strongly disagree	31	8.1	29	7.6	60	7.8
	Disagree	14	3.6	26	6.8	40	5.2
	Neutral	42	10.9	37	9.6	79	10.3
	Agree	61	15.9	82	21.4	143	18.6
	Strongly agree	236	61.5	210	54.7	446	58.1
My school has proper management of garbage (solid & waste)	Strongly disagree	40	10.4	53	13.8	93	12.1
	Disagree	23	6.0	20	5.2	43	5.6
	Neutral	67	17.4	74	19.3	141	18.4
	Agree	88	22.9	97	15.3	185	24.1
	Strongly agree	166	43.2	140	36.5	306	39.8
My school has proper menstrual management (separate room, availability of pad, pain killer medicine)	Strongly disagree	46	23.7	63	29.4	109	26.7
	Disagree	24	12.4	32	15.0	58	13.7
	Neutral	42	21.6	27	12.6	69	16.9
	Agree	27	13.9	19	8.9	46	
	Strongly agree	55	28.4	73	34.1	128	31.4
Total		384	100.0	384	100.0	768	100.0

Respondents' Subjective-norms on WASH

Table 11 depicts the students' subjective-norms regarding WASH services based on seven questions. In response to the statement "my friends think that I can use

the toilet properly", about three-fourth of the total respondents (74%) articulated agreement, with a 10 percentage point difference between improved (79%) and unimproved schools (69%). The proportion of students who disagreed with the statement was more than double in unimproved (22%) compared to improved schools (10%). The majority of the respondents chose "all of my friends think" (47%) in total, with more than half of respondents in improved schools (55%) and two in five students in unimproved schools (40%) answering in this way. The proportion of students who agreed with "my teacher thinks that I can use the toilet properly" was higher in improved school (56%) compared to the unimproved schools (43%).

Female respondents were asked whether they can comfortably use school toilets during their menstruation period. The proportion who agreed was higher in improved schools (66%) compared to the unimproved ones (57%). In contrast, the proportion who disagreed was higher (31%) in unimproved schools than improved schools (20%). More than half (55%) of respondents agreed that their teacher thinks that they can use the toilet properly, with a proportion of 72% in improved schools. This proportion was lower in unimproved schools (59%). Furthermore, most of the respondents (76%) agreed that their teacher thinks that they wash their hands with soap and water appropriately. The proportion who agreed was higher (86%) in improved schools compared to the unimproved schools (66%). Simultaneously, in response to the statement "my friends think that I can wash my hands with soap and water applying seven steps and 20 seconds", about two-thirds (68%) of respondents agreed from improved schools, which was higher than the proportion in unimproved schools (Table 11).

Table 11. *Subjective-norms of Respondents*

Variables		School WASH Situation					
		Improved		Unimproved		Total	
		N	%	N	%	N	%
My friends think that I can use the toilet properly	Strongly disagree	30	7.8	64	16.7	94	12.2
	Disagree	8	2.1	20	5.2	28	3.6
	Neutral	41	10.7	36	9.4	77	10.0
	Agree	92	24.0	74	19.3	166	21.6
	Strongly agree	213	55.5	190	49.5	403	52.5
How many of your friends think that you can use the toilet properly	No one thinks	52	13.5	53	13.8	105	13.7
	Some do not think	16	4.2	29	7.6	45	5.9
	Neutral	60	15.6	54	14.1	114	14.8
	Some think	46	12.0	93	24.2	139	18.1
	All of them think	210	54.7	155	40.4	365	47.5
My teacher thinks that I can use the toilet properly	Strongly disagree	31	8.1	48	12.5	79	10.3
	Disagree	28	7.3	20	5.2	48	6.2
	Neutral	35	9.1	87	22.7	122	15.9
	Agree	74	19.3	64	16.7	138	18.0
	Strongly agree	216	56.2	165	43.0	381	49.6
My friends think that my girlfriends and I can use school toilets comfortably during menstruation*	Strongly disagree	30	15.5	46	21.5	76	18.6
	Disagree	9	4.6	18	8.4	27	6.6
	Neutral	26	13.4	28	13.1	54	13.2
	Agree	40	20.6	48	22.4	88	21.6
	Strongly agree	89	45.9	74	34.6	163	40.0
How many of your teachers think that you should use the toilet properly	Strongly disagree	58	15.1	84	21.9	142	18.5
	Disagree	22	5.7	34	8.9	56	7.3
	Neutral	27	7.0	40	10.4	67	8.7
	Agree	54	14.1	79	20.6	133	17.3
	Strongly agree	223	58.1	147	38.3	370	48.2
My teacher thought that I could wash my hands with soap and water by applying seven steps and 20 seconds	Strongly disagree	18	4.7	58	15.1	76	9.9
	Disagree	9	2.3	23	6.0	32	4.2
	Neutral	26	6.8	51	13.3	77	10.0
	Agree	75	19.5	78	20.3	153	19.9
	Strongly agree	256	66.7	174	45.3	430	56.0
My friends think that I can wash hands with soap and water by applying seven steps and 20 seconds	Strongly disagree	33	8.6	57	14.8	90	11.7
	Disagree	22	5.7	25	6.5	47	6.1
	Neutral	68	17.7	65	16.9	133	17.3
	Agree	83	21.6	77	20.1	160	20.8
	Strongly agree	178	46.4	160	41.7	338	44.0
Total		384	100.0	384	100.0	768	100.0

*Questions only for female students'

Respondents' Self-efficacy on WASH

Respondents' self-efficacy was assessed through four questions related to school WASH services. Of the total respondents, three in five had strong confidence; whilst only 2% did not have confidence that they could purify water before drinking. The researcher found only 2 percentage points of difference between improved (60%) and unimproved (62%) schools on this question. In response to the statement "I think that I can use the toilet properly", the majority (68%) of the total respondents responded with "strongly agree," while very few (4%) strongly disagreed. A majority (76%) of respondents from improved schools strongly agreed that they can use the toilet properly, a higher proportion than that of respondents in unimproved schools (60%). Furthermore, few (6%) respondents were neutral, and 5% disagreed.

In response to the statement "I believe that I can wash hands using soap and water with seven steps and for 20 seconds," 87% of the respondents from improved schools agreed, which was higher than the proportion in unimproved school (78%). However, the proportion who disagreed was more than double in unimproved (11%) than improved schools (5%). From the table, it is clear that most of the respondents agreed that they believe they and their girlfriends can use the toilet properly during menstruation, with just 2 percentage points of difference between improved (63%) and unimproved (65%) schools. On the other hand, disagreement was lower (16%) in improved compared to unimproved schools (24%). Table 12 presents the data related to respondents' self-efficacy on school WASH facilities.

Table 12. *Respondents' Self-efficacy*

Variables		School WASH Situation					
		Improved		Unimproved		Total	
		N	%	N	%	N	%
I believe that I can purify water before drinking	Strongly disagree	24	6.2	44	11.5	68	8.9
	Disagree	11	2.9	4	1.0	15	2.0
	Neutral	27	7.0	37	9.6	64	8.3
	Agree	96	25.0	61	15.9	157	20.4
	Strongly agree	226	58.9	238	62.0	464	60.4
I believe that I can use the toilet properly	Strongly disagree	14	3.6	16	4.2	30	3.9
	Disagree	6	1.6	34	8.9	40	5.2
	Neutral	17	4.4	29	7.6	46	6.0
	Agree	55	14.3	76	19.8	31	17.1
	Strongly agree	292	76.0	229	59.6	521	67.8
I believe that I can wash hands using soap and water with seven steps and 20 seconds	Strongly disagree	13	3.4	26	6.8	39	5.1
	Disagree	8	2.1	16	4.2	24	3.1
	Neutral	29	7.6	43	11.2	72	9.4
	Agree	51	13.3	83	21.6	134	17.4
	Strongly agree	283	73.7	216	56.2	499	65.0
I believe that my girlfriends and I can use the toilet properly during menstruation*	Strongly disagree	17	8.8	36	16.8	53	13.0
	Disagree	14	7.2	17	7.9	31	7.6
	Neutral	41	21.1	22	10.3	63	15.4
	Agree	34	17.5	49	22.9	83	20.3
	Strongly agree	88	45.4	90	42.1	178	43.6
Total		384	100.0	384	100.0	768	100.0

*Questions only for female students'

Respondents' Intention on School WASH

Nine questions assessed the intention on school WASH. Most of the respondents (83%) agreed and very few (8%) disagreed that they were keen on drinking clean and pure water. Similarly, the desire for equal access for all students to school tap water was higher (84%) in improved than unimproved schools (75%). Furthermore, 87% of the respondents agreed in improved schools; a higher proportion than was found in unimproved schools (79%). The proportion who disagreed was nearly double in unimproved than improved schools (8%), on the statement that they had intention to defecate only in toilets. A majority in both types of schools, (88%

from improved and 73% from unimproved) voiced their intention to defecate human feces in toilets only.

Three-fourths of students in improved schools and (58%) from unimproved schools voiced their intention that all their school friends use toilets to defecate. In total, the proportion keen on using school toilets during menstruation was higher in improved schools (89%) compared to unimproved schools (78%). In contrast, the proportion who disagreed was more than double in unimproved schools (19%) than improved schools (8%). Furthermore, the majority of students in both types of schools agreed that they were keen on washing hands using soap and water for 20 seconds by applying seven steps, with only eight percentage points of difference between improved (88%) and unimproved schools (80%). In schools, the majority, (91% from improved and 82% from unimproved schools) expressed their interest to use soap and water while bathing.

The majority (72%) of the respondents strongly agreed that they intended to use Danta Manjan (toothpaste) to clean their teeth, followed by 13% who agreed, and 6% who were undecided. Among both types of schools, the strong agreement to use Danta Manjan (toothpaste) or Jadibuti (herb) was higher (76%) in improved schools compared to the proportion in unimproved schools (68%). The proportion who strongly disagreed was 1 percentage point higher (6%) in unimproved schools compared to improved schools (5%). In the same way, the intention to keep the school clean and healthy was strongly agreed to by the majority (77%) of the respondents, followed by 11% who agreed, and 5% who strongly disagreed. The proportion of strongly disagreed was nearly three times higher (8%) in unimproved compared to improved schools (3%). Table 13 below presents the details of the data, in this regard.

Table 13. *Respondents' Intention on School WASH Services*

Variables		School WASH Situation					
		Improved		Unimproved		Total	
		N	%	N	%	N	%
I am keen on drinking clean and pure water	Strongly disagree	21	5.5	41	10.7	62	8.1
	Disagree	9	2.3	16	4.2	25	3.3
	Neutral	18	4.7	25	6.5	43	5.6
	Agree	35	9.1	63	16.4	98	12.8
	Strongly agree	301	78.4	239	62.2	540	70.3
I desire equal access to all students (physical & visual disabled and small children in school tap	Strongly disagree	11	2.9	31	8.1	42	5.5
	Disagree	8	2.1	14	3.6	22	2.9
	Neutral	43	11.2	52	13.5	95	12.4
	Agree	60	15.6	63	16.4	123	16.0
	Strongly agree	162	68.2	224	58.3	486	63.3
I intend to defecate only in toilets	Strongly disagree	14	3.6	40	10.4	54	7.0
	Disagree	15	3.9	18	4.7	33	4.3
	Neutral	18	4.7	46	12.0	64	8.3
	Agree	45	11.7	50	13.0	95	12.4
	Strongly agree	292	76.0	230	59.9	522	68.0
I intend that all of my school friends use toilets during defecation	Strongly disagree	10	2.6	24	6.2	34	4.4
	Disagree	9	2.3	13	3.4	22	2.9
	Neutral	38	9.9	38	9.9	76	9.9
	Agree	36	9.4	85	22.1	121	15.8
	Strongly agree	291	75.8	224	58.3	515	67.1
I am keen on that all my girlfriends and I use toilets during menstruation*	Strongly disagree	5	2.6	36	16.8	41	10.0
	Disagree	6	3.1	5	2.3	11	2.7
	Neutral	13	6.7	8	3.7	21	5.1
	Agree	24	12.4	50	23.4	74	18.1
	Strongly agree	146	75.3	115	53.7	261	64.0
I am keen on washing hands using soap and water for 20 seconds, applying seven steps	Strongly disagree	15	3.9	20	5.2	35	4.6
	Disagree	5	1.3	16	4.2	35	4.6
	Neutral	26	6.8	39	10.2	65	8.5
	Agree	31	8.1	82	21.4	113	14.7
	Strongly agree	307	79.9	227	59.1	534	69.5
I am interested in using soap and water at bath	Strongly disagree	11	2.9	21	5.5	32	4.2
	Disagree	15	3.9	7	1.8	22	2.9
	Neutral	9	2.3	39	10.2	48	6.2
	Agree	40	10.4	57	14.8	97	12.6
	Strongly agree	309	80.5	260	67.7	569	74.1
I am interested in using dantamanjan (tooth paste)/jadibuti(herb) while cleaning teeth	Strongly disagree	18	4.7	29	7.6	47	6.1
	Disagree	10	2.6	8	2.1	18	2.3
	Neutral	20	5.2	30	7.8	50	6.5
	Agree	42	10.9	57	14.8	99	12.9
	Strongly agree	294	76.6	260	67.7	554	72.1

I intend to keep my school clean and healthy	Strongly disagree	11	2.9	29	7.6	40	5.2
	Disagree	4	1.0	8	2.1	12	1.6
	Neutral	15	3.9	25	6.5	40	5.2
	Agree	32	8.3	53	13.8	85	11.1
	Strongly agree	322	83.9	269	70.1	591	77.0
Total		384	100.0	384	100.0	768	100.0

*Questions only for female students'

Water Drinking Practices at School

Table 14 depicts the results of a study in which the respondents from schools with improved and unimproved WASH services were asked about their water drinking practices while at school. The students mentioned seven main methods of drinking water at school. Among them, directly by hands was popular in both types of schools with 17 percentage points of difference between improved (78%) and unimproved schools (61%). In a similar way, drinking water directly by mouth under the tap was a more frequent response in unimproved (29%) compared to improved schools (17%). The improved schools had fewer (28%) shared drinking water bottles than the unimproved (40%) for drinking water. The research found that nearly one-third (30%) of the respondents in improved schools used their bottle while drinking water, which was only 2 points different from the proportion in unimproved schools (28%).

The respondents who articulated that they drink water directly by hands or directly by mouth under a tap, were asked the supplementary question: "do you wash your hands before drinking," and the majority (93%) and more than three in four (78%) of the respondents said yes from improved and unimproved schools, respectively. Twice as many students in unimproved (22%) compared to improved schools (9%) revealed that they did not wash hands before drinking water. Table 14 presents the data related to water drinking practices.

Table 14. *Water Drinking Practices at School*

Variables		School WASH Situation					
		Improved		Unimproved		Total	
		N	%	N	%	N	%
How do you drink water at your school *	By hands	299	77.9	235	61.5	534	69.5
	Directly by mouth under the tap	67	17.4	113	29.4	180	23.4
	Plastic cups shared with other students	55	14.3	49	12.8	104	13.5
	Cups shared with others	53	13.8	45	11.7	98	12.8
	Shared bottles	108	28.1	130	39.9	238	31.0
	Own cups	54	14.1	81	21.1	135	17.6
	Own bottle	114	29.7	107	27.9	221	28.8
	Other			1	0.3	1	0.1
Total		384	100.0	384	100.0	768	100.0
Do you wash your hands before drinking, if you drink by hands or by mouth directly under the tap	Yes	303	93.2	231	78.3	534	86.1
	No	22	6.8	64	21.7	86	13.9
Total		325	100.0	295	100.0	620	100.0

*Multiple responses

Sanitation Practices at School

Respondents were asked seven questions to assess their sanitation practices. The majority (89%) of respondents stated that they usually defecate in the toilet, which was higher in improved (92%) than unimproved schools (86%). In contrast, less than one-tenth of respondents in unimproved schools (8%), and 6% of respondents from improved schools normally defecate off school premises. The majority (87.5%) of the respondents in both schools used only water as an anal cleaning material, with only a 1-point difference between unimproved (88%) and improved schools (87%). Respondent, who used green leaf/normal paper had twice of high of a proportion in unimproved (5%) that improved schools (2%).

Overall, the majority (93%) of respondents in both schools washed their hands at school, with only a 6 percentage point difference between improved (96%) and

unimproved schools (90%). Of the respondents who did not wash their hands at school; the majority of them (54%) gave as a reason the unavailability of soap and inadequate water, with just a 2 percentage point difference between the two groups. More than two-thirds (68%) of the respondents gave unavailability of water and nearly two-thirds (65%) gave inadequate water at school as reasons for not washing their hands during school time. More than one-tenth of respondents (11%) did not wash their hands at school because the water point is far from the classroom.

Of the total 714 (93%) of respondents who wash hands at school, nearly all (91%) said that they used to wash hands at a specific place in the school. The majority of respondents were found to have used both soap and water while washing hands, with only 4 percentage points of difference between the two groups (improved: 87%, unimproved: 83%). The majority of respondents washed hands before and after eating (85%) and after using toilets (56%). The proportion of students in improved schools which washed their hands before and after having a meal (89%) was higher than in unimproved schools (79%) (Table 15).

Table 15. *Sanitation Practices at School*

Variables		School WASH Situation					
		Improved		Unimproved		Total	
		N	%	N	%	N	%
Usually defecate places at school	At school toilet	354	92.2	329	85.7	683	88.9
	Toilet off school premises	24	6.2	37	9.6	61	7.9
	Open defecate	6	1.6	18	4.7	24	3.1
Usually used anal cleaning materials	Toilet paper	44	11.5	27	7.0	71	9.2
	Water only	333	86.7	339	88.3	672	87.5
	Green leaf/normal paper	7	1.8	18	4.7	25	3.3
Wash hands at school	Yes	368	95.8	346	90.1	714	93.0
	No	16	4.2	38	9.9	54	7.0
Total		384	100.0	384	100.0	768	100.0
If yes, handwashing places at school	Certain washing places	341	92.7	310	89.6	651	91.2
	Anywhere within school yard	27	7.3	36	10.4	63	8.8
Total		368	100.0	346	100.0	714	100.0
If yes, hand washing materials at school	Water only	33	9.0	41	11.8	74	10.4
	Both (water & mud/ash)	15	4.1	18	5.2	33	4.6
	Both (water & soap)	320	87.0	286	82.7	606	84.9
	Other			1	0.3	1	0.1
Total		368	100.0	346	100.0	714	100.0
If yes, usually handwashing time while at school*	Before and after eating	329	89.4	275	79.5	604	84.6
	After using toilet	254	69.0	145	41.9	399	55.9
	After playing	212	57.6	100	28.9	312	43.7
Total		368	100.0	346	100.0	714	100.0
If no, causes of not washing hands at school*	Unavailability of soap	10	62.5	26	68.4	36	66.7
	Dirty wash basins	9	56.2	21	55.3	30	55.6
	Girls are washing hands	4	25.0	9	23.7	13	24.1
	Boys are washing hands	4	25.0	8	21.1	12	22.2
	Handwashing station is out of order	5	31.2	15	39.5	20	37.0
	Crowded	5	31.2	7	18.4	12	22.2
	Inadequate water	10	62.5	25	65.8	35	64.8
	Far from classroom	3	18.8	3	7.9	6	11.1
	Too high to reach	3	18.8	8	21.1	11	20.4
Total		16	100.0	38	100.0	54	100.0

*Multiple responses

Hygiene Practices by Students

Five questions were asked to assess hygiene practices at school. Table 16 depicts that an equal proportion (83%) answered that the expected handwashing time is before and after having a meal and after using the toilet. An equal proportion of respondents washed hands after using the toilets (87%) and before and after having the food (87%); higher proportions than those in unimproved schools, which were 80% and 78%, respectively. In total, the majority (78%) of the respondents responded that water and soap were their commonly used handwashing materials, with 11 percentage points of difference between improved (84%) and unimproved schools (78%).

Overall, more than two-thirds (65%) and three-fifths of all respondents stated that diarrhoea and stomachache were highly likely diseases if hands are not washed properly. Diarrhoea and stomach diseases were mentioned more often in unimproved schools (66% and 61%) than in improved schools (65% and 59%), respectively. Most respondents from both types of schools responded that all their school and household members washed their hands before and after using toilets (Table 16).

Table 16. *Hygiene Practices by Respondents*

Variables		School WASH Situation					
		Improved		Unimproved		Total	
		N	%	N	%	N	%
Normally handwashing time*	After using toilet	333	86.7	308	80.2	641	83.5
	Before and after eating	336	87.5	299	77.9	635	82.7
	After playing games	237	61.7	157	40.9	394	51.3
	Other			2	0.5	2	0.3
Commonly used materials for handwashing*	Water only	60	15.6	107	27.9	167	21.7
	Both water & soap	321	83.6	281	73.2	602	78.4
	Both water & mud	19	4.9	27	7.0	46	6.0
	Both water & ash	19	4.9	13	3.4	32	4.2
Potential diseases, if we do not wash hands properly*	Diarrhoea	249	64.8	252	65.6	501	65.2
	Cholera	163	42.4	142	37.0	305	39.7
	Dysentery	95	24.7	101	26.3	196	25.5
	Jaundice	53	13.8	66	17.2	119	15.5
	Typhoid	74	19.3	51	13.3	125	16.3
	Stomach-ache	227	59.1	233	60.7	460	59.9
	Cough & cold	141	36.7	136	35.4	277	36.1
	Do not know	14	3.6	3	0.8	17	2.2
Handwashing before eating and after using toilet at school	All members	352	65.6	243	63.3	495	64.5
	Some members	89	23.2	80	20.8	169	22.0
	Do not know	43	11.2	61	15.9	104	13.5
Handwashing before eating and after using the toilet at home	All members	267	69.5	228	59.4	495	64.5
	Some members	77	20.1	102	26.6	179	23.3
	Do not know	40	10.4	54	14.1	94	12.2
Total		384	100.0	384	100.0	768	100.0

*Multiple responses

Health Status of the Students'

Table 17 illustrates the health status and related issues of the student respondents six months before the study period. More than two-thirds (64%) of students became sick in unimproved schools, which was higher than the proportion in the improved schools (41%). All students who were sick, were asked: "which diseases did you catch". In response, the majority (43%) and (38%) of student respondents indicated either seasonal infections or diarrheal disease, respectively. Diarrhoea and seasonal infectious diseases were commonly seen in unimproved schools (43% for

both) and 42% and 38% in the improved schools, respectively. The least seen disease in improved schools was jaundice (11%), whereas it was dysentery (8%) in unimproved schools.

In response to "what caused the mentioned disease," the majority (55%) of students answered referencing the use of unsafe drinking water, which was only different by 8 percentage points between improved (50%) and unimproved schools (58%). Similarly, more than a quarter (28%) in unimproved schools and one-third in improved responded that the use of contaminated water was the primary cause of the mentioned disease. Among the 403 total infected respondents, three-fourths visited health facilities, whilst the remaining quarter did not. The number of respondents who visited the hospital was higher in improved schools (79%) than unimproved schools (72%). Among the 102 respondents who did not visit the hospital, 60% of students from improved schools and 83% of students in unimproved schools were cured at their home, whilst 39% from improved schools and 17% from unimproved schools visited the traditional healer. Table 17 presents the details of the data.

Table 17. *Health Status of the Students*

Variables		School WASH Situation					
		Improved		Unimproved		Total	
		N	%	N	%	N	%
Sickness six months before the study period	Yes	157	40.9	246	64.1	403	52.5
	No	227	59.1	138	35.9	365	47.5
Total		384	100.0	384	100.0	768	100.0
If yes, what disease had occurred*	Diarrhoea	50	31.8	104	42.3	154	38.2
	Cholera	24	15.3	51	20.7	75	18.6
	Dysentery	9	5.7	48	19.5	57	14.1
	Skin disease	19	12.1	40	16.3	59	14.6
	Eye infection	28	17.8	36	14.6	64	15.9
	Jaundice	11	7.0	26	10.6	37	9.2
	Respiratory disease	24	15.3	55	22.4	79	19.6
	Seasonal infections	66	42.0	106	43.1	172	42.7
	Water born disease	24	15.3	39	15.9	63	15.6
	Do not know	8	5.1	7	2.8	15	3.7
Total		157	100.0	246	100.0	403	100.0
Visited health facilities during the illness	Yes	124	79.0	177	72.0	301	74.7
	No	33	21.0	69	28.0	102	25.3
Total		157	100.0	246	100.0	403	100.0
If no, where did you get health services to recover	Home	20	60.0	57	82.6	77	75.5
	Traditional healer	13	39.4	12	17.4	25	24.5
Total		33	100.0	69	100.0	102	100.0

*Multiple responses

Students Absenteeism by Background Variables

Initially, the researcher assessed the students' absences, and the reasons behind them. Later on, the researcher examined the types of absences with information from the school and parents as well. The analysis found that more than two thirds (69%) of students had never been absent, in total. This number varied by 22 percentage points between improved schools (80%) and unimproved schools (58%). The proportion of absent students in unimproved schools (42%) was two-times higher than in improved schools (20%).

In addition, the researcher investigated whether missing students were absent from school during the past six months. From the study, it was noted that nearly one-third (31%) of students were absent one to three days, and 9% were absent at least 10-12 days. The majority of the respondents' absences were less than nine days in both schools, with just 20 percentage points of difference between improved (82%) and unimproved schools (62%). Absences of between 10-18 days were lower in both schools; but this proportion was higher in unimproved (37%) compared to improved schools (18%).

The study analysed the reasons behind the respondents' absences and found sickness and religious work at home/society to be its prime causes. The majority (85%) of respondents mentioned sickness, and nearly six in ten (57%) of them said religious responsibilities. All reasons for absence had a higher proportion in unimproved compared to improved schools, as multiple responses were allowed for this question. The type of absence where a student simply did not show up to school (as opposed to leaving midway through the day or being rejected by the school) was significant in both types of school. Furthermore, half of the respondents articulated that school families sometimes noticed their absence, with just 10 percentage points of difference between improved (56%) and unimproved schools (46%). Similarly, 45% and 34% of respondents in improved and unimproved schools, respectively, said that their family noticed their absence at school sometimes.

Less than half (45%) of girl respondents said that they missed 3-4 school days in a month due to menstruation, whilst nearly a quarter (24%) of them missed up to 5 days. As per study findings, the proportion of students who missed 1-4 days due to menstruation was higher in unimproved schools (79%) compared to improved schools (67%), however, the proportion who were absent for up to 5 days was lower in unimproved (21%) than improved schools (33.3%) (Table 18).

Table 18. *School Absenteeism*

Variables		School WASH Situation					
		Improved		Unimproved		Total	
		N	%	N	%	N	%
Absent	Yes	78	20.3	160	41.7	238	31.0
	No	306	79.7	224	58.3	530	69.0
Total		384	100.0	384	100.0	768	100.0
If yes, absent days in the past six months	1-3	28	35.9	45	28.1	73	30.7
	4-6	20	25.6	30	18.8	50	21.0
	7-9	16	20.5	25	15.6	41	17.2
	10-12	6	7.7	16	10.0	22	9.2
	13-15	4	5.1	20	12.5	24	10.1
	16-18	4	5.1	24	15.0	28	11.8
Reasons for absence*	Illness	65	83.3	137	85.6	202	84.9
	Inadequate water	10	12.8	38	23.8	48	20.2
	Inadequate toilet	24	30.8	68	42.5	92	38.7
	Poor handwashing station	15	19.2	38	23.8	53	22.3
	Religious work at home or society	41	52.6	94	58.8	135	56.7
	I do not like the teacher	5	6.4	20	12.5	25	10.5
	Fear of punishment	4	5.1	14	8.8	18	7.6
Total		78	100.0	160	100.0	238	100.0
Types of absent at school*	Not presented at school	78	100.0	156	97.5	234	98.3
	Left school at mid-time	37	47.4	78	48.8	115	48.3
	Rejected by school			7	4.4	7	2.9
Total		78	100.0	160	100.0	238	100.0
Do school notice your absent	Never	2	2.6	15	9.4	17	7.1
	Only once	15	19.2	36	22.5	51	21.4
	Sometimes	44	56.4	74	46.2	118	49.6
	Usually	12	15.4	21	13.1	33	13.9
	Always	5	6.4	14	8.8	19	8.0
Do family notice you absent at school	Never	2	2.6	15	9.4	17	7.1
	Only once	7	9.0	25	15.6	32	13.4
	Sometimes	35	44.9	54	33.8	89	37.4
	Usually	23	29.5	38	23.8	61	25.6
	Always	11	14.1	28	17.5	39	16.4
Total		78	100.0	160	100.0	238	100.0
Absent days at menstruation period (only for girls)	1-2	9	27.3	26	31.7	35	30.4
	3-4	13	39.4	39	47.6	52	45.2
	Up to 5	11	33.3	17	20.7	28	24.3
Total		33	28.7/100.0	82	71.3/100.0	115	100.0

*Multiple responses

Educational Achievement of the Students

The researcher observed differences in the educational achievements of the students between the two groups (Table 19). The overall data, in this regard, shows that 36% of the total respondents obtained B/B+, whereas the students from improved schools had higher (46%) achievements compared to the unimproved schools (27%). The study concluded that 22% of the students in improved, and less than 18% in unimproved schools, obtained A/A+ grades at the final examinations. Respondents who received scores of C/C+, D+, or lower, were more common in unimproved schools (56%) than in improved schools (31%).

In response to the question "what are the activities that the school organises to improve students' educational achievements", most students responded, "do not do anything", with just 6% percentage points of difference between the two groups (improved: 42%, unimproved: 36%). Extra activities and motivational programmes were found to be more common in improved schools than in unimproved schools. Furthermore, only 3% of respondents from improved schools opined that the school organised health services to develop students' educational achievements, whilst no respondents in unimproved schools answered this option.

More than four in five (82%) of respondents articulated that they could obtain a high score if they attend school regularly, while the remaining less than one-fifth (18%) said they could not. More than three-fifth (61%) of girls responded that menstruation does not hamper their educational achievements, whilst nearly two-fifth (40%) of them said that menstruation hampered their educational achievement (Table 19).

Table 19. *Educational Achievement by Background Variables*

Variables		School WASH Situation					
		Improved		Unimproved		Total	
		N	%	N	%	N	%
Educational achievement by students'	A/A+	86	22.4	68	17.7	154	20.1
	B/B+	178	46.4	102	26.6	280	36.5
	C/C+	79	20.6	103	26.8	182	23.7
	D+ or below	41	10.7	111	28.9	152	19.8
Organised activities for students' educational achievement by school*	Games, quiz context, and speaking competition	55	14.3	31	8.1	86	11.2
	Teachers teach very well	54	14.1	77	20.1	131	17.1
	Slogan			16	4.2	16	2.1
	Motivational programme	45	11.7	31	8.1	76	9.9
	Good environment and facilities within the school	37	9.6	23	6.0	60	7.8
	Punishment	23	6.0	8	2.1	31	4.0
	Strict rule	13	3.4	56	14.6	69	9.0
	Pay fine, if absent	13	3.4	34	8.9	47	6.1
	Parental meetings	24	6.2	2	0.5	26	3.4
	Health services at school	13	3.4			13	1.7
	Do not do anything	163	42.4	140	36.5	303	39.5
Have regular attendance help to get a higher score	Yes	300	78.1	327	85.2	627	81.6
	No	84	21.9	57	14.8	141	18.4
Do menstruation period hamper your study (Only Girls)	Yes	79	34.1	94	45.2	173	39.3
	No	153	65.9	114	54.8	267	60.7
Total		384	100.0	384	100.0	768	100.0

*Multiple responses

Association between School WASH Facilities and Students' Health Status

This theme is based upon the first objective. More than two-thirds (64%) of the respondents from the unimproved schools had been sick, which was a significantly higher proportion than the respondents from improved schools (41%), ($p<0.001$). Simultaneously, those respondents who had above average attitudes on school WASH were less sick (47%) compared to those with average or below average

attitudes (63%), ($p<0.001$). In other words, there is a statistically significant association between attitude towards school WASH and students' health status. Following this, about two-thirds (63%) of respondents who had average or below average subjective-norms on school WASH had been sick, which was 18 percentage points higher than those who had above average subjective-norms (45%), ($p<0.001$). The respondents' self-efficacy on school WASH was found to have a strong association with their health status. Those respondents who had average or below average self-efficacy on school WASH had been 23% more likely to be sick compared those having above average self-efficacy (48%), ($p<0.001$). The researcher further found the respondents' intentions on school WASH to be significant to their health status. Students with average or below average intentions on school WASH were 20% more likely to be sick than the students with above average intentions on school WASH facilities (46%), ($p<0.001$).

Nearly three-fifths (59%) of the respondents aged 15-19 got ill, and more than half of respondents between 10-14 (51%) reported that they have been ill ($p=0.082$). This p-value asserts that there is not sufficient evidence to claim that the respondents' age and health status are statistically associated. More female respondents were sick compared to males (57% versus 47%), ($p<0.05$). In other words, there was an association between the sex of the respondents and their health status. More than half (54%) of those in grade seven reported being ill; compared to 53% in grade eight, and half of the students in grade six ($p=0.665$). More than two-thirds (67%) of Dalits and nearly two-thirds (62%) of Brahmin/Chhetri-Terai respondents reported having been ill; higher proportions than those of other castes (55%), Janajati (43%), and Brahmin/Chhetri-Hill (39%) ($p<0.001$). More than half (53%) of Hindu respondents and less than half (48%) of non-Hindu respondents reported having been sick

(p=0.227). The analysis showed insufficient evidence to claim a significant association between the religion of the students and their health status.

The quantitative findings demonstrated that school WASH facilities are significant to students' health status, which was consistent with qualitative findings as students from unimproved schools more frequently got sick than those from the improved ones. Some diseases are easy to diagnose and can be predicted, however, some can neither be predicted nor be diagnosed without a clinical test. The qualitative findings emphasized that unimproved school WASH facilities act as one significant source of disease that will make students ill. A student from the unimproved school shared his experience as;

> *We always drink water directly (using mouth or hand and mouth) on the tube well/hand pump. There is no provision for water purification in our school. Almost we all never wash our hands and mouth before drinking. Soap is rarely available at the handwashing stations and toilets of schools. Furthermore, there are no separate handwashing stations, the drinking water point and handwashing stations are the same. For these reasons, we often get ill. (IDI, student).*

This student mentioned here verbatim that they became sick through consuming contaminated water and practicing unhygienic WASH behaviour at the school. Simply, if students took water directly from the point without applying any purification measures, they had more chances to be sick. Another girl student shared her experience of how school WASH facilities hinder the students' health status. She used to avoid drinking water throughout the morning so that she would not have to visit the school toilet for defecation, and even for urination. She states:

> *The toilets in our school are so dirty and stink so far as to make it hard to breathe, and I feel like vomiting while entering the toilet. I never had water at the morning to evening 5 o'clock on school days, so I would not visit school toilets for excretion. Throughout school time, I bear both urination and feces. Once I returned home, I defecated. Finally, I have got a urogenital infection due to a water deficiency in my body (IDI, student).*

From the verbatim quoted above, it can be concluded that the poor school WASH facilities have a direct impact on the students' health status. Besides this, students' WASH behaviour is equally responsible for making students sick. In this regard, the researcher observed that only a few students wash their hands before drinking in the improved schools, though there exist fixed handwashing facilities including running water and soap. However, the researcher did not see running water and soap in the unimproved schools during the field visit. Almost all students from unimproved schools drink water directly through hands without washing it. Furthermore, almost all of them join their mouth to the water point (tube-well/hand pump) to drink.

The quantitative findings indicate that male students were less likely to be sick than the female students. The researcher found that male students were less likely to report being sick than female students in both schools. The use of contaminated water without purification, lack of water at toilets, lack of sanitation and hygiene services, and smell of toilets were equally reported as determinations factors for the health of students. The following table presents the bivariate analysis of background characteristics and health status of the students.

Table 20. *Background Characteristics of Students by Health Status*

Variables		Illness No N	%	Yes N	%	Total N	%	χ^2	*P*-value
School WASH Situation ***	Unimproved	138	35.9	246	64.1	384	100.0	41.35	0.000
	Improved	227	59.1	157	40.9	384	100.0		
Attitude on WASH***	Average or below	92	36.7	159	63.3	251	100.0	17.67	0.000
	Above average	273	52.8	244	47.2	517	100.0		
Subjective norms***	Average or below	116	36.9	198	63.1	314	100.0	23.85	0.000
	Above average	249	54.8	205	45.2	454	100.0		
Self-efficacy ***	Average or below	67	30.6	152	69.4	219	100.0	35.22	0.000
	Above average	298	54.3	251	45.7	549	100.0		
Intention***	Average or below	83	33.9	162	66.1	245	100.0	26.87	0.000
	Above average	282	53.9	241	46.1	523	100.0		
Age group	10-14	310	49.0	323	51.0	633	100.0	3.02	0.082
	15-19	55	40.7	80	59.3	135	100.0		
Sex of students*	Male	189	52.5	171	47.5	360	100.0	6.7	0.010
	Female	176	43.1	232	56.9	408	100.0		
Class/Grade of students	Grade 6	116	50.0	116	50.0	232	100.0	0.82	0.665
	Grade 7	117	46.4	135	53.6	252	100.0		
	Grade 8	132	46.5	152	53.5	284	100.0		
Caste/ethnicity ***	Brahmin/Chhetri-Hill	136	60.7	88	39.3	224	100.0	38.7	0.000
	Brahmin/Chhetri-Terai	79	38.3	127	61.7	206	100.0		
	Janajati	71	56.8	54	43.2	125	100.0		
	Dalit	48	33.3	96	66.7	144	100.0		
	Other castes	31	44.9	38	55.1	69	100.0		
Religion	Non-Hindu	72	52.2	66	47.8	138	100.0	1.5	0.227
	Hindu	293	46.5	337	53.5	630	100.0		
Total		365	47.5	403	52.5	768	100.0		

Chi-square is Significant at ***p<0.001, **p<0.01 and *p<0.05

Association between School WASH Facilities and Students' School Regularity

This theme addresses the second objective. Interviews with the students provided valuable information on school absence in the past six months, which is

different between improved and unimproved schools. For instance, the study shows that a significant proportion of students were not actually absent at school and that students in improved schools are absent less often than those in unimproved schools. The analysis shows that the majority (80%) of respondents from improved schools never missed school days, which was 22 percentage points higher than that of the unimproved schools (58%), ($p<0.001$).

Students' attitude, subjective-norms, self-efficacy, and intentions were significantly associated with their school absences. Students with scores above the mean on school WASH (74.5%) had higher regularity by 16 percentage points compared to those with average or below average scores in attitude on school WASH (58%), ($p<0.001$). In a similar vein, students' school regularity was only different by 13 percentage points between those with average or below average subjective norms on school WASH (38.5%) and scores above the average (26%), ($p<0.001$). The self-efficacy of students on school WASH also has a significant association with their school regularity ($p<0.001$), in which the group with average or below average scores had nearly 57% regularity; whilst the above average group had 74% regularity. Students with average or below scores in intention on school WASH behaviour had higher cases of absenteeism (43.3%) compared with those with above average intention (25%), ($p<0.001$).

One-third of the respondents aged 15-19 had been absent at school, whilst 30% missed classes between the ages of 10-14 years. The study further shows no association between the age groups of students and their absenteeism. Overall, 37% of the respondents from grade eight were absent at school, followed by 29% in grade seven and 26% in grade six. The study shows a statistically significant difference between the grades of the student and absenteeism ($p<0.05$). Similarly, the ethnicity

of the students was found to have a strong association with school absenteeism ($p<0.001$); the other castes and Dalit caste had higher proportions of absenteeism (48% and 47%, respectively) than Brahmin/Chhetri-Terai (38%), Brahmin/Chhetri-Hill (17%), and Janajati (17%). In contrast, the analysis found no statistically significant association between the religion of the students and their school absenteeism ($p=0.444$).

In support of the quantitative findings, the qualitative results illustrated that the school WASH facilities might contribute pull and push factors for the students' school regularity, especially for girls in adolescence. To the girls studying in unimproved schools, WASH facilities may be a push factor; whilst for those who are enrolled in improved ones, it could be a pull factor. The school WASH facilities are equally important for the male students, as one of the students responded:

> *I sometimes skipped school due to the non-cleaned toilet. The school toilets had no water; we should bring water in the ruined bucket from the tap that is constructed in school yard. Alternatively, we should bear the defecation until we reach home or visit the villagers' toilet near the school (IDI, student).*

The safe and gender-based separate sanitation facilities are significant for both sexes, especially for menstruating-aged girls, which may increase the students' presence at the school. Thus, it could be one of the best solutions to reduce school absenteeism and poor educational performance.

Indeed, poor WASH in schools affected children's ability to learn in several ways: first, WASH-related infections hindered school-aged children's physical development and secondly, it reduced their cognitive development. These infectious diseases forced many school children to be absent from school. The students' teachers

are also not immune to the effect of WASH-borne diseases. In this regard, one of the teachers responded:

> *Poor school facilities not only affect students' absenteeism and learning abilities, it also impaired teachers' health and teaching performance as well. The effects of the disease for teachers includes absenteeism, which decreases the teaching proficiency that has direct impacts on students' learning performance* (KII, teacher).

From the quotation above, it should be noted that the effect of diseases in teachers impaired teaching performance and increased absenteeism of teachers, which has a direct impact upon the learning of the students. In case of the scarcity of water or contaminated water, students failed to drink enough water which, in turn, resulted in decreased physical activity that reduced the child's ability to learn. Students will be healthy if water is easily accessible to them.

A participating teacher shared their understanding about girls' school absenteeism in this way:

> *Most adolescent girls who are at menstruating age skip schools for 3-5 days: some for seven days a month. If girls dropped classes at the school time and would not comeback 3-5 days, we (school staff) understand that they were in period (KII, teacher).*

The improved school WASH facility is essential, particularly for girls' safe and healthy participation at school, because an unimproved school decreases the students' participation at school. Besides, the school WASH facilities, MHM equipment and sanitary pads at school play a vital role in increasing girls' school attendance. One of the participants in KII said;

After the free distribution of sanitary pads, girls are more likely to attend school than before (KII, parent).

Although the availability of improved WASH facilities and pads is a basis of school regularity for girls, teaching by peers is even more significant in reducing the absenteeism caused by menstruation. Here is an excerpt from KII;

The teaching of MHM by peers (upper-grade girl students) is more effective than teachers, even if they are female, in reducing the absenteeism caused by menstruation (KII, teacher).

It reveals that teaching on menstruation is more effective by peers or upper-grade peers than from the teachers, whether male or female, which ultimately reduces the girls' school absenteeism. On the contrary, some participants asserted that more than the school WASH facilities, religious functions in the society, household chores, and family responsibility were significant causes for the students' school absenteeism, regardless of the gender of the students. Here are some excerpts from IDI students;

I have never missed a single school day due to the lack of school WASH facilities. However, I skipped classes due to participation in religious functions at society, household chores, and family tours (IDI student).

I missed school days due to illness and other responsibilities but never missed due to poor school WASH facilities and menstruation difficulty (IDI, student).

From the quotation above, it can be concluded that school WASH facilities affect students' school regularity, whether male or female. However, female students were more likely to be absent than the males because female students have to take more responsibilities on household chores and community-level religious tasks. In the same line, the quantitative data showed that more male students were absent in unimproved schools compared to improved schools. Furthermore, the girls with

unimproved school WASH facilities reported more absences than those in the improved schools. Still, it depends on the extent of necessity of the class; if the course is more important, then the students attend the school. Table 21 presents the bivariate analysis of students' absenteeism by background variables.

Table 21. *Students' Absenteeism by Background Variables*

Variables		Absenteeism						χ^2	P-value
		Yes		No		Total			
		N	%	N	%	N	%		
School WASH Situation ***	Improved	78	20.3	306	79.7	384	100.0	40.93	0.000
	Unimproved	160	41.7	224	58.3	384	100.0		
Attitude on WASH***	Average or below	106	42.2	145	57.8	251	100.0	22.03	0.000
	Above average	132	25.5	385	74.5	517	100.0		
Subjective norms***	Average or below	121	38.5	193	61.5	314	100.0	14.14	0.000
	Above average	117	25.8	337	74.2	454	100.0		
Self-efficacy ***	Average or below	95	43.4	124	56.6	219	100.0	21.98	0.000
	Above average	143	26.0	406	74.0	549	100.0		
Intention***	Average or below	106	43.3	139	56.7	245	100.0	25.35	0.000
	Above average	132	25.2	391	74.8	523	100.0		
Age group	10-14	193	30.5	440	69.5	633	100.0	0.42	0.517
	15-19	45	33.3	90	66.7	135	100.0		
Sex	Male	111	30.8	249	69.2	360	100.0	0.008	0.930
	Female	127	31.1	281	68.9	408	100.0		
Grade of the student *	Grade 6	61	26.3	171	73.7	232	100.0	7.08	0.029
	Grade 7	73	29.0	179	71.0	252	100.0		
	Grade 8	104	36.6	180	63.4	284	100.0		
Ethnicity/Caste of the students ***	Brahman/Chhetri-Hill	38	17.0	186	83.0	224	100.0	63.81	0.000
	Brahman/Chhetri-Terai	78	37.9	128	62.1	206	100.0		
	Janajati	21	16.8	104	83.2	125	100.0		
	Dalit	68	47.2	76	52.8	144	100.0		
	Other castes	33	47.8	36	52.2	69	100.0		
Religion of the students	Non-Hindu	39	28.3	99	71.7	138	100.0	0.568	0.444
	Hindu	199	31.6	431	68.4	630	100.0		
Total		238	31.0	530	69.0	768	100.0		

Chi-square is Significant at ***p<0.001, **p<0.01 and *p<0.05

Association between School WASH Facilities and Students' Educational Achievement

This theme addresses the third objective. The school WASH facilities have a significant association with the grade score of the students ($p<0.001$). The association is highlighted by the fact that students from improved schools scored a B+ and above in higher proportions (69%), whereas in unimproved schools, this proportion was 44%. Following this, attitude on school WASH facilities also had a significant association with educational achievements ($p<0.01$). 51.4% of students who had average or below average attitudes on school WASH facilities scored B or above, whereas 59% of the students with above average attitudes reached this educational achievement. Similarly, subjective-norms and students' academic achievements also have a significant association, ($p<0.001$). Accordingly, 49% of students with average or below average subjective-norms achieved a B/B+, whilst 61.6% of students with average and above scores in this metric achieved a grade score of B or above. Self-efficacy and educational achievements have a significant association, ($p<0.01$). 48% of students who were average or below average in self-efficacy on school WASH scored a B or above, whereas 60% of students with above-average self-efficacy scored a score of B/B+ or above. Similarly, intentions on school WASH facilities are significantly associated with students' academic achievements ($p<0.001$), as 47% of students with average and below average intentions achieved a B or above, whereas 61% with above average intentions achieved the same score.

Similarly, the gender of the students and their educational achievements were found to have a statistically significant association, ($p<0.001$). Accordingly, 61.6% of male respondents achieved a grade score of B or above in their summative evaluation, which is 10% higher than females (52%). The grade of the students had a strong

association with educational achievements, ($p<0.001$), shown by the fact that 42.7% respondents from grade six, 59.2% from grade seven, and 65.1% from grade eight scored a B or above in their final examination. The research further found that the ethnicity of the respondents had a statistically significant association with educational achievements, ($p<0.001$). Accordingly, 70% of the Brahman/Chhetri-Hill students have obtained higher grades (B or above) than others. Considering the religion, 58% of those students who followed Hindu religion scored higher academic achievement (B or above) than non-Hindus 23%, ($p<0.01$). Based on the statistical tests, it can be said that there is a significant association between religion and educational achievement.

Equally, in the qualitative findings, the school WASH facility plays a crucial role in supporting educational achievements. Improved school WASH facilities may create inclusive and effective learning environments to ensure children's access to education and enhance the learning outcomes. At the same time, it could unlock the future for thousands of students around the nation. One of the teachers positively relates school WASH facilities to students' educational achievements, articulating:

> *Our school has good WASH facilities. Each child has access and has no scarcity relating to WASH components. We provide health and reproductive education from the experts/guest lecturer. It is one of the causes for our students getting higher grades/scores than other schools' children (KII, teacher).*

The improved school WASH services may create an inclusive and effective learning environment based on ensuring children's access to education and enhancing learning outcomes. The given quotation indicates that for better achievement in education, school WASH facilities require appropriate and contextual hardware

(physical infrastructure) and software (educational environment). It also includes MHM facilities and reproductive education.

School WASH facilities; hardware (infrastructure of drinking water, hand washing station with soap and water, and toilet facilities), and software (WASH and reproductive education including MHM) enables the promotion of sanitation and hygiene in students. Both components mentioned above strengthen the learning environment of the children at the school. As a result, their school regularity would be high, and their academic achievement would also be improved. In this regard, one of the participants responded:

> *The lack of WASH facilities and their poor management at school is terrible for health and bad for the school environment. It creates several problems within the school; diseases emerge from the inadequate WASH services, which ultimately increase absenteeism and decrease educational performance. It has also reduced teacher's performance on teaching and learning activities (KII, teacher).*

With reference to this quotation, it can be said that school WASH facilities are a primary basis for the students' and teachers' health, school retention, and educational achievements. So, to increase the regularity rate of the students, especially for adolescent girls, WASH facilities with handwashing equipment and gender-based separate toilets with MHM rooms are essential. The respondents reported the effect of poor school WASH facilities in hampering students' educational achievements like this:

> *Nearly half of girls are absent in our school for at least three days and some for a week out of four in each month due to inadequate WASH facilities and cleaning materials at the school. Their education is certainly affected compared to those students who are regular, whether they are girls or boys.*

Another thing is that nearly half of the girls perform more poorly at the adolescent age than they did before (KII, teacher).

As the teacher participant suggested in the above excerpt, besides the poor school WASH facilities, mental trauma, embarrassment, and emotional changes caused by puberty and menstruation might have been the subsidiary causes of girls' absenteeism. Table 22 presents the data related to the association of educational achievement and the background variables.

Table 22. *Educational Achievement by Background Variables*

Variables		Students Grade Score in the Final Examination										χ^2	P-value
		A/A+		B/B+		C/C+		D+/below		Total			
		N	%	N	%	N	%	N	%	N	%		
WASH Situation ***	Improved	86	22.4	178	46.4	79	20.6	41	10.7	384	100.0	58.13	0.000
	Unimproved	68	17.7	102	26.6	103	26.8	111	28.9	384	100.0		
Attitude on WASH*	Average or below	46	18.3	83	33.1	77	30.7	45	17.9	251	100.0	10.04	0.01
	Above average	108	20.9	197	38.1	105	20.3	107	20.7	517	100.0		
Subjective norms***	Average or below	49	15.6	105	33.4	97	30.9	63	20.1	314	100.0	18.18	0.000
	Above average	105	23.1	175	38.5	85	18.7	89	19.6	454	100.0		
Self-efficacy**	Average or below	33	15.1	72	32.9	70	32.0	44	20.1	219	100.0	13.71	0.003
	Above average	121	22.0	208	37.9	112	20.4	108	19.7	549	100.0		
Intention ***	Average or below	41	16.7	74	30.2	83	33.9	47	19.2	245	100.0	21.63	0.000
	Above average	113	21.6	206	39.4	99	18.9	105	20.1	523	100.0		
Age group	10-14	117	18.5	235	37.1	157	24.8	124	19.6	633	100.0	6.78	0.079
	15-19	37	27.4	45	33.3	25	18.5	28	20.7	135	100.0		
Sex of students***	Male	97	26.9	125	34.7	55	15.3	83	23.1	360	100.0	40.53	0.000
	Female	57	14.0	155	38.0	127	31.1	69	16.9	408	100.0		
Current grade ***	Grade 6	28	12.1	71	30.6	69	29.7	64	27.6	232	100.0	36.25	0.000
	Grade 7	47	18.7	102	40.5	59	23.4	44	17.5	252	100.0		
	Grade 8	79	27.8	107	37.7	54	19.0	44	15.5	284	100.0		
Caste ***	Brahman/Chhetri- Hill	62	27.7	95	42.4	39	17.4	28	12.5	224	100.0	71.54	0.000
	Brahman/Chhetri-Terai	50	23.4	71	34.5	59	28.6	26	12.6	206	100.0		
	Janajati	8	6.4	43	34.4	27	21.6	47	37.6	125	100.0		
	Dalit	20	13.9	44	30.6	39	27.1	41	28.5	144	100.0		
	Other castes	14	20.3	27	39.1	18	26.1	10	14.5	69	100.0		
Religion **	Non-Hindu	16	11.6	54	39.1	30	21.7	38	27.5	138	100.0	11.70	0.008
	Hindu	138	21.9	226	35.9	152	24.1	114	18.1	630	100.0		
Total		154	20.1	280	36.5	182	23.7	152	19.8	768	100.0		

Chi-square is Significant at ***p<0.001, **p<0.01 and *p<0.05.

Effects of School WASH Facilities on Students' Health Status, School Regularity, and Educational Achievement

This section is related to the fourth objective of the study and assessed net effects through multivariate analysis. It has been divided into three sections, each measuring the effect of improved school WASH facilities: i) health status of the students; ii) students' school regularity; and iii) educational achievements. These are presented below.

School WASH Facilities and Health Status of the Students

The multivariate logistic regression shows that only some covariates could predict sickness among students (Table 23). In the first model, the improved school WASH facilities showed a positive and statistically significant effect on students' health status, since those with improved WASH facilities at school were more likely to feel healthy (cOR=0.388; 95% CI; 0.290-0.519, p<0.001) than those from unimproved schools.

Equally, in the second model, students' health status remained significant (aOR=0.419; 95% CI; 0.309-0.568, p<0.001), even after inclusion of other variables such as attitudes, subjective-norms, self-efficacy, and intentions. Model 2 further explains that students with average or below average subjective-norms and self-efficacy were more likely to have been sick (aOR=0.688; 95% CI; 0.481-0.982, p<0.05) and (aOR=0.471; 95% CI; 0.313-0.708, p<0.001), respectively, compared to students with above average subjective-norms and self-efficacy. In contrast, students' attitude on school WASH is not a significant predictor for the students' health status (aOR=1.082; 95% CI; 0.729-0.1.607).

Uniformly, in the third model, the effect on students' health status was significant after adjusting the other four variables (aOR=0.425; 95% CI; 0.313-0.576, p<0.001) which was also increased after inclusion of TPB covariates. Model 3 further

illustrates that the students with average or below average self-efficacy were more likely to report sickness (aOR=0.511; 95% CI; 0.330-0.791, p<0.01) compared to the students having above average self-efficacy. On the contrary, students' attitude, subjective-norms, and intention on WASH behaviour were not significant predictors for the students' health status (aOR=1.174; 95% CI; 0.767-1.798), (aOR=0.702; 95% CI; 0.490-1.006), (aOR=0.795; 95% CI; 0.513-1.232) keeping all theory-based variables constant in the same model.

Similarly, in the fourth model, students' health status remained statistically significant and increased even after the inclusion of all socio-demographic covariates and theory-based variables (aOR=0.509; 95% CI; 0.343-0.756, p<0.001). Model 4 further explains that students with average or below average self-efficacy were more likely to have been sick (aOR=0.511; 95% CI; 0.327-0.800, p<0.01) compared to those with above average self-efficacy on school WASH facilities. The sex and caste/ethnicity of the students were significant predictors of their health status. The female and Dalit students were more likely to have been sick (aOR=1.562; 95% CI; 1.146-2.130, p<0.01) and (aOR=2.057; 95% CI; 1.248-3.392, p<0.01), respectively, compared to male and other higher caste students.

Equally, in the qualitative findings, the participants revealed that inadequate WASH facilities impaired their health status. Both male and female students said that they hardly feel comfortable using school toilets due to the lack of water and smell from the toilets. The analysis further shows that impure and scarce drinking water, poor sanitation facilities, and hand hygiene facilities that do not include running water and soap at the school affected students' health status. Additionally, students are more likely to get to sick in summer than in winter due to scarcity and contamination of water, as well as consumption or unpurified water.

Similarly, qualitative findings show that some students, especially girls, never used school toilets, not even for urination. They bear feces until they return home, and

occasionally visited the villagers' house near the school for excretion, which ultimately may cause urogenital infection. Finally, qualitative information shows that among various causes, poor WASH facilities are another significant cause of sickness in students. As had been observed, the researcher found that almost all students from improved schools practiced handwashing after using the toilet. Almost all washed their hands using soap before drinking water while there was enough stored water. The school taps are managed according to the students' height, so all of them have easy access to drinking water. Furthermore, disabled-friendly toilets are being constructed. Pupils at schools without improved WASH facilities did not practicing handwashing after using the toilet, due to the lack of water within the toilets and unavailability of soap. Moreover, the students have no access to soap and water due to the unavailability of fixed handwashing facilities.

During the observation, the researcher further noted that improved schools are equipped with separate sanitation facilities for girls including MHM rooms. There are facilities with running water and a dustbin for disposing used sanitary materials. However, other required materials like sanitary materials, hooks for hanging the clothes, soap for cleaning, lighting within the room, and health care facilities during the menstruation period were not found in the schools. In unimproved schools several facilities are still lacking, such as separate MHM rooms, and fixed handwashing stations with soap. There are limited sources of drinking water as there was only one hand pump/tube well for the entire school. They were also consuming water directly through their mouths and hands or only their mouths by putting their mouths to the water pump. Further, almost all students directly drink water from the pump without washing their hands. Although schools have one big dustbin provided by the LG, the school ground was observed to be very unclean. Table 23 presents the multivariate analysis with the representative data.

Table 23. *Multivariate Logistic Regression of Students Sickness Predicted by Students'*

Variables		Model I cOR 95% CI	Model II aOR 95% CI	Model III aOR 95% CI	Model IV aOR 95% CI
School WASH Situation	Unimproved	1.00	1.00	1.00	1.00
	Improved	0.388*** (0.290-0.519)	0.419*** (0.309-0.568)	0.425*** (0.313-0.576)	0.509** (0.343-0.756)
Attitude	Average or below		1.00	1.00	1.00
	Above average		1.082 (0.729-1.607)	1.174 (0.767-1.798)	1.226 (0.794-1.895)
Subjective norms	Average or below		1.00	1.00	1.00
	Above average		0.688* (0.481-0.982)	0.702 (0.490-1.006)	0.743 (0.511-1.078)
Self-efficacy	Average or below		1.00	1.00	1.00
	Above average		0.471*** (0.313-0.708)	0.511** (0.330-0.791)	0.511** (0.327-0.800)
Intention	Average or below			1.00	1.00
	Above average			0.795 (0.513-1.232)	0.735 (0.464-1.166)
Age group	10-14				1.00
	15-19				1.045 (0.679-1.609)
Sex of students	Male				1.00
	Female				1.562** (1.146-2.130)
Class/Grade of students	Grade 6				1.00
	Grade 7				1.030 (0.678-1.565)
	Grade 8'				1.038 (0.659-1.635)
Caste	Brahmin/Chhetri -Hill				1.00
	Brahmin/Chhetri -Terai				1.341 (0.847-2.124)
	Janajati				0.967 (0.542-1.726)
	Dalit				2.057** (1.248-3.392)
	Other castes				1.030 (0.518-2.049)
Religion	Non-Hindu				1.00
	Hindu				0.977 (0.581-1.640)
Constant		1.783***	3.520***	3.607***	2.075
Cox & Snell R Square		0.053	0.092	0.093	0.115
2 Log likelihood		1021.053	988.685	987.632	969.397

***p<0.001, **p<0.01 and *p<0.05

School WASH facilities and School Regularity

The below table illustrates the prediction of students' absence based on their socio-demographic characteristics through multilevel modeling (Table 24). The first level model shows that the school WASH facilities have a positive and statistically significant effect on students' school regularity. The result further asserts that the students from improved schools were more likely to exhibit regular attendance (cOR=2.802; 95% CI; 2.033-3.862, $p<0.001$) than those from schools with unimproved WASH facilities.

Equally, in the second model, the effect on students' school regularity was statistically significant effect even after the inclusion of the four theory-based variables (aOR=2.503; 95% CI; 1.798-3.484, $p<0.001$), which shows a rapid increment. Model 2 further illustrates that the students with average or below average self-efficacy were more likely to have been absent (aOR=1.572; 95% CI; 1.038-2.381, $p<0.05$) than the students with above-average self-efficacy on school WASH. In contrast, attitude and subjective-norms were not found to be significant predictors for the students' school regularity (aOR=1.272; 95% CI; 0.843-1.918) and (aOR=1.194; 95% CI; 0.808-1.763), respectively, keeping all other variables constant in the same model.

Similarly, in the third model, unimproved school WASH facilities were found to be a significant predictor of the students' school absenteeism (aOR=2.462; 95% CI; 1.766-3.43, $p<0.001$) after the inclusion of all socio-covariates and theory-based variables. Model 3 further presents that for all four theory-based variables; average and below average scores in attitude, subjective-norms, self-efficacy, and intentions on WASH behaviour at school were not significant predictors for the students’ school absenteeism (aOR=1.142; 95% CI; 0.733-1.781), (aOR=1.156; 95% CI; 0.779-1.715),

(aOR=1.418; 95% CI; 0.908-2.212), and (aOR=1.347; 95% CI; 0.856-2.119), respectively, keeping all other variables constant in the same model.

At the same time, model four depicts that school WASH facilities, students' school grades, and ethnicity/caste were significantly associated with the students' absences. Students at schools with unimproved WASH facilities were more likely to be absent (aOR=1.616; 95% CI; 1.047-2.497, $p<0.05$) than those from schools with improved WASH facilities. In a similar vein, grade eight students were more likely to have been absent (aOR=0.591; 95% CI; 0.355-0.984, $p<0.05$) compared to grade six and seven. Furthermore, Brahmin/Chhetri-Terai (aOR=0.524; 95% CI; 0.314-0.881, $p<0.05$), Dalit (aOR=0.300; 95% CI; 0.174-0.516, $p<0.001$), and other castes (aOR=0.342; 95% CI; 0.164-0.713, $p<0.01$) were more likely to have been absent compared to other castes, such as Brahmin/Chhetri-Hill and Janajati, after the inclusion of other socio-covariates and theory-based variables. Students' attitude, subjective-norm, self-efficacy, intention, age, sex, and religion were not significant predictors of the students' school absenteeism in the same model. There was inadequate evidence to claim that these variables are significant predictors of the students' school absenteeism, keeping all covariates in the same model.

Equally, in the qualitative findings, poor school WASH facilities, limited sanitation services, lack of cleanliness, stink, unavailability of water at toilets, and handwashing stations without soap were reported as barriers to school retention. Beside this, WASH-related diseases including fever, eye infections, and skin diseases were secondary causes of school absenteeism for both sexes. In the same way, another cause was students' participation in religious functions, household chores and the fear of punishment at school. Regarding the participation of girl students at school, menstruation-related causes like pain and over-bleeding during the period, fear of

harassment, and fear of leakage are reported as the causes of absenteeism. In unimproved schools, MHM and required sanitary materials during the period were found to be dominant causes for girls' absenteeism compared to girls in the improved schools. By contrast, some qualitative information indicated that school WASH facilities had no significant effect on students' school absenteeism. For instance, some participants in the study articulated:

> *I have never missed a single day of school due to the lack of school WASH facilities IDI, student).*
>
> *Children missed school days due to participation in religious functions in the society, household chores, and family tour (KII, parent).*
>
> *I missed school days due to sickness and other household responsibilities but never missed due to school WASH and menstruation-related difficulties (IDI, student).*

From the analysis, it can be said that there are several causes for school absenteeism regardless of sex (male or female). With that said, school WASH is a major cause of school absences. Table 24 presents the representative data related to school absence and the WASH situation from multivariate analysis.

Table 24. *Multivariate Logistic Regression of School Absentees Predicted by Students'*

Variables		Model I cOR 95% CI	Model II aOR 95% CI	Model III aOR 95% CI	Model IV aOR 95% CI
School WASH Situation	Unimproved	1.00	1.00	1.00	1.00
	Improved	2.802*** (2.033-3.862)	2.503*** (1.798-3.484)	2.462*** (1.766-3.431)	1.616* (1.047-2.494)
Attitude	Average or below		1.00	1.00	1.00
	Above average		1.272 (0.843-1.918)	1.142 (0.733-1.781)	1.077 (0.686-1.689)
Subjective-norms	Average or below		1.00	1.00	1.00
	Above average		1.194 (0.808-1.763)	1.156 (0.779-1.715)	1.157 (0.767-1.744)
Self-efficacy	Average or below		1.00	1.00	1.00
	Above average		1.572* (1.038-2.381)	1.418 (0.908-2.212)	1.550 (0.981-2.449)
Intention	Average or below			1.00	1.00
	Above average			1.347 (0.856-2.119)	1.276 (0.792-2.057)
Age group	10-14				1.00
	15-19				1.471 (0.937-2.308)
Sex of students	Male				1.00
	Female				1.009 (0.721-1.412)
Class/Grade of students	Grade 6				1.00
	Grade 7				0.935
	Grade 8				0.591* (0.355-0.984)
Caste/Ethnicity	Brahmin/Chhetri-Hill				1.00
	Brahmin/Chhetri-Terai				0.526* (0.314-0.881)
	Janajati				1.057 (.517-2.160)
	Dalit				0.300*** (0.174-0.516)
	Other castes				.342** (0.164-0.713)
Religion	Non-Hindu				1.00
	Hindu				0.965 (0541-1.722)
Constant		1.400**	0.836	0.813	2.065
Cox & Snell R Square		0.053	0.075	0.077	0.119
2 Log likelihood		909.233	891.214	889.568	853.416

***p<0.001, **p<0.01 and *p<0.05

School WASH Facilities and Educational Achievement

Table 25 illustrates students' educational achievement using multilevel modeling. From the study, it was predicted that only some covariates significantly affected students' educational achievement.

In the first model, the school WASH facility has a positive and statistically significant effect on students' educational achievement. The result shows that the students from schools with improved WASH facilities were more likely to get a score of B or above (cOR=2.769; 95% CI; 2.062 -3.720, $p<0.001$) than those who were from schools with unimproved WASH facilities. In the same way, model 2 indicates that the students from improved schools got higher educational achievements (B/B+) (aOR=2.753; 95% CI; 2.028-3.737, $p<0.001$) than those from unimproved schools, after adjusting other theory-based variables. Furthermore, model 2 depicts that the students with above average subjective-norms on school WASH behaviour were more likely to obtain higher academic achievements (aOR=1.528; 95% CI; 1.065-2.192, $p<0.05$) compared to the students with average or below average subjective-norms. In contrast, students' attitude and self-efficacy on WASH behaviour had no significant effect on their educational achievements (aOR=0.739; 95% CI; 0.497-1.101) and (aOR=1.347; 95% CI; 0.903-2.009), respectively, keeping other variables constant in the same model.

Equally, in the third model, the improved school WASH facilities had a more significant effect on students' educational achievement (aOR=2.702; 95% CI; 1.988-3.672, $p<0.001$) than that of the unimproved schools even after the inclusion of theory-based variables. Model 3 further explains that the students with above average subjective-norms related to school WASH behaviour were more likely to get higher academic achievements (B or above) (aOR=1.478; 95% CI; 1.027-2.127, $p<0.05$) than those reporting average or below average subjective-norms, keeping all socio-demographic characteristics constant in the same model. In contrast, students'

attitudes, self-efficacy, and intentions on school WASH had no significant effect on the students' educational achievements. There is insufficient evidence to claim that students with above average attitude, self-efficacy, and intentions are more likely to obtain higher academic achievements (aOR=0.651; 95% CI; 0.423-1.003), (aOR=1.192; 95% CI; 0.776-1.832), and (aOR=1.416; 95% CI; 0.916-2.190), respectively, keeping all other socio-covariates constant in the same model.

Equally, in the fourth model, the effect on students' educational achievement was statistically significant after adjusting all socio-covariates and theory-based variables. This effect was approximately four times larger (aOR=8.312; 95% CI; 5.082-13.597, $p<0.001$) than that exhibited by model three. The female students were more likely to obtain higher educational achievements (aOR=0.694; 95% CI; 0.495-0.972, $p<0.05$) compared to the male students. Simultaneously, students of grades seven and eight were more likely to score higher educational achievements (aOR=4.427; 95% CI; 2.725-7.190, $p<0.001$) and (aOR=7.659; 95% CI; 4.441-13.307, $p<0.001$), respectively, compared to students in grade six, after the inclusion of all other socio-covariates and theory-based variables in the same model. Additionally, Janajati students were more likely to obtain higher academic achievements (aOR=0.473; 95% CI; 0.249-0.900, $p<0.05$) compared to the students of other castes.

By contrast, there was insufficient evidence to claim students' attitude, subjective-norms, self-efficacy, and intentions on school WASH, as well as age, religion, health status, and school regularity effect educational achievements. For instance, students' attitude on school WASH (aOR=0.659; 95% CI; 0.413-1.051), subjective-norms (aOR=1.196; 95% CI; 0.808-1.771), self-efficacy (aOR=0.901; 95% CI; 0.563-1.442), intention (aOR=1.494; 95% CI; 0.918-2.431), age (aOR=1.378; 95% CI; 0.871-2.182), religion (aOR=1.249; 95% CI; 0.703-2.220), health status (aOR=0.710; 95% CI; 0.502-1.004), and school regularity (aOR=1.312; 95% CI;

0.903-1.908) had no significant effect after inclusion of all socio-covariates and theory-based variables in the same model.

In contrast to improved schools, WASH facilities were a significant predictor of students' better educational performance in unimproved schools. The qualitative findings suggest that sufficient and potable water, adequate sanitation facilities, and proper hygiene management with MHM equipment are fundamental for ensuring quality education and the students' better performance. However, more than that, the students missed classes due to several other significant reasons. For instance, the respondents stated:

> *I don't think a school WASH facility hampers students' educational achievement.*
>
> *Still, some students who left classes and miss schools for many days, whatever the causes, perform poorly in course and get lower marks in final examinations (KII, parent).*

In support of this quotation, another male student from an unimproved school expressed his experiences as:

> *A single day of absence can play a significant role in exam results. I missed nearly ten school days, which hindered me in my final exam score. I always secured the first position in the class, but I became third this exam. Studying peers' notebooks and self-study is not as effective as physical classes (IDI, student).*

From the qualitative information, it can be said that all students agreed that school absenteeism ultimately hampers students' educational achievements, no matter what the reasons were.

Contrary to the quantitative findings, the qualitative findings suggested that girl students performed poorly in their adolescence. The prominent causes could be mental trauma, embarrassment, and emotional changes accompanied with puberty and menstruation rather than from the condition of school WASH facilities. Table 25 presents

the data related to the multivariate analysis of the students' achievement, school WASH, and socio-demographics.

Table 25. *Multivariate Logistic Regression of Students Educational Achievement by Students'*

Variables		Model I cOR 95% CI	Model II aOR 95% CI	Model III aOR 95% CI	Model IV aOR 95% CI
School WASH Situation	Unimproved	1.00	1.00	1.00	1.00
	Improved	2.769*** (2.062-3.720)	2.753*** (2.028-3.737)	2.702*** (1.988-3.672)	8.312*** (5.082-13.597)
Attitude	Average or below		1.00	1.00	1.00
	Above average		0.739 (0.497-1.101)	0.651 (0.423-1.003)	0.659 (0.413-1.051)
Subjective norms	Average or below		1.00	1.00	1.00
	Above average		1.528* (1.065-2.192)	1.478* (1.027-2.127)	1.196 (0.808-1.771)
Self-efficacy	Average or below		1.00	1.00	1.00
	More than average		1.347 (0.903-2.009)	1.192 (0.776-1.832)	0.901 (0.563-1.442)
Intention	Average or below			1.416	1.00
	Above average			1.416 (0.916-2.190)	1.494 (0.918-2.431)
Age group	10-14				1.00
	15-19				1.378 (0.871-2.182)
Sex of students	Male				1.00
	Female				0.694* (0.495-0.972)
Class/Grade of students	Grade 6				1.00
	Grade 7				4.427*** (2.725-7.190)
	Grade 8				7.659*** (4.441-13.307)
Caste	Brahmin/Chhetri-Hill				1.00
	Brahmin/Chhetri-Terai				1.649 (0.989-2.750)
	Janajati				.473* (0.249-0.900)
	Dalit				0.854 (0.495-1.473)
	Other castes				1.872 (0.875-4.005)
Religion	Non-Hindu				1.00
	Hindu				1.249 (0.703-2.220)
Health Status	Non-sick				1.00
	Sick				0.710 (0.502-1.004)
School Absent	No-absent				1.00
	Absent				1.312 (0.903-1.908)
Constant		0.794*	0.617**	0.595**	0.094***
Cox & Snell R Square		0.060	0.073	0.076	0.215
2 Log likelihood		1004.279	993.619	991.167	865.794

***p<0.001, **p<0.01 and *p<0.05

Students' Health Status and School Regularity

Table 26 depicts the prediction of students' school regularity based on their health status and other socio-covariates through multilevel modeling (Table 26). The first model shows that the students' health status significantly affects students' school regularity (cOR=3.160; 95% CI; 2.585-5.042, p<0.001). Putting it into another way, those students enrolled in unimproved school WASH facilities were more likely to be sick than those in improved schools. Moreover, the result asserts that a students' health status has a statistically significant effect even after the inclusion of all socio-covariates from model 2, students' health status (aOR=2.997;95% CI; 2.102-4.274, p<0.001), school WASH facilities (aOR=0.604; 95% CI; 0.392-0.928, p<0.05), castes; whether Brahman/Chhetri-Terai (aOR=0.313; 95% CI; 0.149-0.658, p<0.01), or Dalit (aOR=0.273; 95% CI; 0.135-0.552, p<0.001). Table 26 makes this data more visible.

Table 26. *Multivariate Logistic Regression of Students School Regularity Practiced by students'*

Selected predictors	Model I			Model II		
	cOR	95% CI		aOR	95% CI	
Students' health status						
No Sick	1.00			1.00		
Sick	3.610***	2.585	5.042	2.997***	2.102	4.274
School WASH Situation						
Unimproved				1.00		
Improved				0.604*	0.392	0.928
Age group						
10-14				1.00		
15-19				1.480	0.938	2.336
Sex						
Male				1.00		
Female				1.155	0.822	1.623
Class/Grade of students						
Grade 6				1.00		
Grade 7				0.753	0.465	1.219
Grade 8				0.675	0.448	1.017
Caste/Ethnicity						
Brahmin/Chhetri-Hill				1.00		
Brahmin/Chhetri-Terai				0.313**	0.149	0.658
Janajati				0.628	0.320	1.235
Dalit				0.273***	0.135	0.552
Other castes				0.941	0.481	1.842
Religion						
Non-Hindu				1.00		
Hindu				0.939	0.521	1.694
Constant	0.213***			0.498		
Cox & Snell R Square	0.077			0.147		
2 Log likelihood	890.594			829.908		

***p<0.001, **p<0.01 and *p<0.05

Students School Regularity and Educational Achievements

Table 27 illustrates the prediction of students' educational achievement based on their school regularity using multilevel logistic regression. Only some covariates are significant predictors of students' educational achievements. As we can see, in model 1, students' school regularity had a positive and statically significant effect on students' educational achievements (cOR=0.641; 95% CI; 0.472-0.872, p<0.01). Analogously, those students who were regular attendees at school were more likely to get higher scores (B or above) than the irregular students. In contrast, students'

educational achievement was not a statistically significant predictor while adjusting for covariates in students' school regularity (aOR=0.755; 95% CI; 0.534-1.123). But the students' health status (aOR=0.695; 95% CI; 0.494-0.976, p<0.05), school WASH facilities (aOR=8.175, 95% CI; 5.021-13.309, p<0.001), sex (aOR=1.405; 95% CI; 1.010-1.954, p<0.05), school grade (aOR=0.124; 95% CI; 0.124-0.074, p<0.001), caste identities; Dalit (aOR=0.265, 95% CI; 0.134-0.524, p<0.001), and other castes (aOR=0.496; 95% CI; 0.247-0.996, p<0.05) were statistically significant predictors for the students' educational achievements. Table 27 shows the details of the relationships and significance levels.

Table 27. *Multivariate Logistic Regression of Students' Educational Achievements by School Regularity*

Selected predictors	Model I			Model II		
	cOR	95% CI		aOR	95% CI	
Students school regularity						
No absent	1.00			1.00		
Absent	0.641**	0.472	0.872	0.775	0.534	1.123
Students' health status						
No Sick				1.00		
Sick				0.695*	0.494	0.976
School WASH Situation						
Unimproved				1.00		
Improved				8.175***	5.021	13.309
Age group						
10-14				1.00		
15-19				0.724	0.458	1.145
Sex of students						
Male				1.00		
Female				1.405*	1.010	1.954
Class/Grade of students						
Grade 6				1.00		
Grade 7				0.124***	0.124	0.074
Grade 8				0.588	0.370	0.841
Caste/Ethnicity						
Brahmin/Chhetri-Hill				1.00		
Brahmin/Chhetri-Terai				0.585	0.277	1.232
Janajati				0.904	0.456	1.794
Dalit				0.265***	0.134	0.524
Other castes				0.496*	0.247	0.996
Religion						
Non-Hindu				1.00		
Hindu				0.824	0.465	1.461
Constant	0.1495***			3.417*		
Cox & Snell R Square	0.010			0.210		
2 Log likelihood	1043.589			870.792		

***p<0.001, **p<0.01 and *p<0.05

Students', teachers', and parental perception on students' health status, school regularity, and educational achievements by school WASH facilities

This section deals with the fifth objective of this study. This objective is to support or differentiate the quantitative findings. The significant findings are presented and blended with objectives one, two, three, and four, which were discussed in the above sections.

The teachers perceived those deficiencies in school WASH facilities impaired a child's health status, school regularity, and educational achievement because they spent their most significant time at school. So, the school environment needs to be clean. The lack of WASH facilities and their poor quality at schools are major causes which deteriorate students' and teachers' health status. Teachers further stated that some diseases can be predicted as they are caused by unimproved WASH facilities; however, some cannot be predicted easily as the disease requires a clinical test. Among the several causes are: i) limited and contaminated water services, ii) limited and poor sanitation facilities, iii) absence of cleaning materials, and iv) handwashing facilities without soap and running water. These causes directly and indirectly impact on students' health status. Some students never used school toilets due to stink, and never drink water at school throughout school days in order to avoid the toilets. They even drink water at home in the morning in order to avoid school toilets in the school during daytime. Parents exposed that school WASH is as crucial as household WASH for protecting children and family members from WASH-borne diseases.

Any school can create pull and push factors for the students, especially adolescent girls. For the same students, schools with improved WASH facilities might be the pull factor, whilst unimproved school facilities can be the push factor. The teacher reported, besides the school WASH facilities, several reasons for students'

absenteeism; for instance: religious functions, marriage functions, household chores, and family responsibility, all of which are neglected by many research scholars. Teachers at schools with improved school WASH facilities revealed that their students never missed school days because of WASH facilities, whilst the teachers from unimproved schools said that many girls were absent, as well as some boys. The main reasons are lack of water and stinking toilets, as reported by the students. In unimproved schools, girls never felt comfortable to use school toilets during the menstruation period, or even when they are not menstruating. Some students visited villagers' toilets (near the school) for defecation while they have complications. In the case of diarrhoea and other health-related problems for both boys and girls, and menstruation for girls, students must go back home and not return to school that day after defecating.

It has been noted that female students from unimproved schools missed 3-5 school days, and some missed nearly seven days. Due to the fear of harassment, mental trauma, anxiety, and fear of leakage, the girls cannot concentrate in the classroom as reported by the girl students from unimproved schools. On the contrary, students from improved schools asserted that they rarely missed school days due to the poor WASH facilities, including MHM facilities. The MHM teaching by peers, especially upper-grade students, was reported as a more effective way to increase girls' regularity at school.

Teachers positively relate school-WASH facilities to students' educational achievements. They opined that school WASH is crucial and plays a significant role in creating educational opportunities, which can brighten the future of thousands of students. Furthermore, they agreed that it is a basis for ensuring children's educational rights and equal opportunity. Pure drinking water, sufficient toilet facilities,

handwashing stations with soap and running water, cleanliness of the school environment and quality of teachers are significant factors for students' educational achievements in improved schools. They further stated that improved school WASH services might create inclusive and effective learning environments, which enhance learning outcomes.

Similarly, the parents reported that schools had poor WASH facilities and improper management. These created terrible health issues and an awful environment within the school, which may lead to several diseases. Ultimately, it affected learning outcomes of the students negatively. Students and parents agreed that whatever the cause of absenteeism, it can hamper their academic achievements. It was also reflected that many girls poorly perform during their adolescence, caused by several problems including mental trauma, embarrassment, and emotional changes during puberty and menstruation. Thus, the school needs sufficient and potable water, adequate sanitation facilities, and proper hygiene management with MHM equipment to ensure quality education and improve students' performance.

Schools with improved WASH facilities served a complete WASH package in schools, whereas the unimproved exhibit fair to poor levels of services. Unimproved schools were reported as having a higher occurrence of diseases related to inadequate WASH, especially lack of handwashing and uncleaned sanitation facilities. Sanitation facilities have no running water in unimproved schools; students need to bring water from outside of the toilets if they have to use the toilet. Furthermore, toilets are not child and disabled friendly and there is a scarcity of cleaning materials such as brushes, cleaning liquids, detergents, or disinfectants. Though toilets are separate for girls and boys, MHM rooms were not found in unimproved schools. There was only one tube-well at the school yard which served all sorts of water necessities for all

school members. The researcher could not see water drainage, and there was no segregation of the waste materials. Plastic and other waste materials were spread around the school grounds. Finally, an appropriate academic environment is needed for better educational achievements. It consists of two sorts of school WASH facilities: i) hardware (physical infrastructure) and ii) software (sound learning environment). The hardware relates to drinking water, handwashing stations with soap and water, and a separate toilet including MHM facilities with cleaning materials. Similarly, software denotes an appropriate learning environment within the school. Both components strengthened the learning environment of the children at the school. As a result, the students' regularity in schools with improved WASH facilities are higher and the performance of the students is improved.

CHAPTER V

Discussion

The purpose of this embedded mixed-methods study was to explore and assess the health status, school regularity, and educational achievements of students in schools with and without improved WASH facilities. My PhD. dissertation aimed to investigate the impacts of school WASH facilities for students. In this chapter, the researcher connected and contrasted the findings with previous research. Furthermore, the chapter discusses how the findings aligned with and informed TPB and HBM to protect students from sickness, absenteeism, and poor educational achievements. Finally, this chapter outlines the strengths and weakness of this PhD. work.

The study has enabled a statistically robust comparison of students' health status, school absenteeism/regularity, and educational achievements between two school types. The results suggest an association between school WASH services and students' health status, school regularity, and academic achievements. They will hopefully help to guide future decision-making on the integration of different school WASH programmes, including health and educational aspects in schools throughout local, federal, and central levels. The discussion is mainly presented based on the quantitative findings and are supported by qualitative findings and links with TPB and HBM theories. Apart from this, it compares present findings with findings from previous studies to support a claim or to differentiate them from each other.

School WASH Facilities and Students' Health Status

Initially, the researcher assessed health status based on school types, age, sex, grade, caste, and religion of the students, as well as theory-based variables from TPB (attitude, subjective-norm, and intention) and HBM (self-efficacy), through the bivariate analysis. In doing so, the H1 hypothesis, which states that students are less

likely to feel sick where school WASH facilities are improved, was accepted ($p<0.001$). Similarly, socio-demographics characteristics of the students such as sex and caste were also significantly associated with the students' health status ($p<0.05$) and ($p<0.001$), respectively. As mentioned above, variables based on TPB (attitude, subjective-norm, and intention) and HBM (self-efficacy), had a strong association with students' health status ($p<0.001$). Students with above average score on all theory-based variables were less likely to get sick than students with below average score.

The results presented from the quantitative study are consistent with qualitative findings. The qualitative findings showed that poor WASH facilities, which had no soap and running water, deteriorated the students' health status. It further depicted that WASH deficiency at schools invites WASH-borne diseases, which might be the cause of students and their family members getting sick. Similar to the present findings, a Matched-Control Trial study in Mali found that an intervention on school-based WASH services positively impacted students' health status, reducing diarrhoeal infections by 29% and respiratory infections by 25% (Trinies, 2016). Similarly, studies from Talaat et al. (2011) and Bowen et al. (2007) found that interventions on school WASH reduced students' school absenteeism caused by sickness. A study carried out by Esrey et al. (1991) similarly to the present study, found that the access to improved WASH at school significantly reduced diarrhoeal diseases. This study also highlighted that school WASH facilities are more significant than water quality in improving students' health.

Our qualitative findings are different from quantitative findings which highlighted that those ways of handling WASH services are equally responsible for students' health status as their access, availability, and sufficiency. Consistent with

present findings Bain et al. (2014) emphasized that an improved school WASH facility is not as important as water quality and safely managed sanitation and hygiene facilities. The authors further pointed that poor water quality and unsafely managed sanitation does not protect the students and community from being sick. In this regard, the researcher observed that few students wash their hands before drinking in improved schools, though they have access to fixed handwashing facilities including running water and soap. However, the researcher did not see running water and soap in the unimproved schools. Almost all students from unimproved schools drink water directly using their hands without washing them. Not only that, almost all directly joined their mouth to the water point (tube well/hand pump) to drink.

Prüss-Ustün et al. (2019) showed that unimproved school WASH services are a determinant of students' global disease burden and health outcomes, especially among young children. Similarly, a systematic review asserted that of the total publications, 78% reported that WASH-related diseases among students significantly reduced after an intervention on school WASH facilities (McMichael, 2019). Another systematic study carried out by Forouzanfer et al. (2019) showed a higher health status in students where improved drinking water and clean sanitation exist, which is in the same line of the present study. This study further stated that unimproved water sources, poor sanitation, and poor personal hygiene were core risk factors for the school and local community (Forouzanfar et al., 2015).

Contrary to the present findings, a cross-sectional study conducted in West Africa by John et al. (2015) showed that the consumption of contaminated water without disinfection measures does not infect students' and local people's health. The assessment further revealed that OD was practiced by most schools and households, which an effect of the lack of latrines in the schools and communities. Although

people are aware of the risks of OD, they practiced it due to their cultural taboo. Almost all households typically discharged waste into the surrounding environment. However, they do not get infected with WASH-borne diseases. Similarly, Abbott et al. (2013) summarized that the prevention, control, and eventual elimination of many WASH diseases, including Neglected Tropical Diseases (NTDs), depends heavily on the availability of improved WASH services in endemic countries, which contradicts the findings by John et al. (2015), and is consistent with the findings of this study.

In the same line as the present study, a cluster-randomised study by Dreibelbis et al. (2014) concluded that school WASH interventions reduced diarrhoea and gastrointestinal-related clinic visits among children younger than five years. The study also revealed substantial reductions in diarrhoea and clinic visits due to the improved water supply, school sanitation, and hygiene promotion at the schools. Furthermore, it emphasized that school WASH interventions served as essential barriers to public transmission of diarrheal disease pathogens among school-aged children, resulting in a reduced health burden among their siblings. In the same vein, in Kenya, a WASH strategy in schools led to a 50% reduction in diarrhoeal disease (Freeman et al., 2012). Similarly, Joshi and Amadi (2013) performed a systematic review that explored the impact of water treatment, hygiene, and sanitary interventions in improving child health. In the same way, authors stated that diarrhoea was the most common infection at the school. The risk factors identified included a lack of education and hygiene practices, which is identical with the present findings.

In line with the present findings, but in a different way, Daset al. (2015) found a positive association of MHM practices to urogenital diseases. The diseases were more likely to occur to those women who used reusable absorbent pads compared to those who used disposable pads. The same research found that people with MHM

education with WASH services are better prepared to prevent disease and use health services effectively. Finally, Chard et al. (2019) stated that the availability of improved school WASH facilities alone may be insufficient to achieve the anticipated health impacts. This task also requires improvements in WASH-related education and practices. The report from UNICEF (2016) presents scientific evidence that inadequate WASH in schools results in dehydration, urinary infections, constipation, and parasitic infections in some countries. The evidence showed that toilet avoidance occurs with insufficient and inadequate facilities and a lack of awareness among teachers and children concerning the importance of WASH and the consequent school policies for drinking and toilet visits.

School WASH Facilities and Students' School Regularity

The analysis of the data accumulated for this study provided valuable information on school absenteeism in the past six months, showing a significant association between school WASH facilities and students' regularity. In this study, the hypothesis, H_1= students are less likely to be absent where improved school WASH facilities exist, was accepted ($p<0.001$). The improved nature of school WASH facilities, as well as grade and caste, were found to have a statistically significant effect on school regularity ($p<0.001$), ($p<0.05$) and ($p<0.001$), respectively. The qualitative findings are in same line with the quantitative results, as improved school WASH facilities were one of the core causes of students' school regularity, especially for menstruating girls. Students' poor relation with their teacher, students' engagement in household and social responsibilities, and poor family background were other causes for students' school absences. Besides this, the unavailability of separate toilets for girls, MHM facilities, and cleaning materials are noted as being equally important for reducing the girls' school regularity.

While triangulating the quantitative and qualitative findings with variables from theories such TPB (attitude, subjective-norm, intention) and HBM (self-efficacy), all variables are significantly associated with students' school regularity. In other words, students with above average scores regarding school WASH were more likely attend school regularly compared to students with below average scores ($p<0.001$), in all variables. It clearly shows that these variables are psychologically determinant factors for being present or absent from school. It depends on personal perceptions.

Now, in support of the present findings, a study in China from Bown et al. (2007) found that adequate WASH facilities in school have a positive impact on students' school regularity. The authors further stated that school WASH programmes reduced the number of missed school days by 54% per year and reduced absenteeism by 42%. In the similar way, another study in the Philipines by Bella et al. (2008) highlighted the finding that adequate school WASH facilities reduced students' school absenteeism by 27% through daily handwashing programmes. Furthermore, this improved students' hygiene behaviour (Bella et al., 2008). Apart from these, a study conducted in India showed that a sanitation programme increased girls' enrollment by one third and enhanced academic performance for both boys and girls by 25% (UN, 2008).

UNICEF (2016) presented the beneficial effects of hygiene interventions, which significantly reduce absenteeism due to infections during and after the intervention. UNICEF further emphasized five major causes of absenteeism at schools: sickness, inadequate WASH services, socio-cultural/religious aspects, household responsibility, and fear of punishment by the teacher. Besides, the study identified menstruation as a significant cause of absenteeism for girl students

(UNICEF, 2016). Another study in the USA by Balfanz and Byrnes (2012) presented three broad causes, similar to those found in the present study and UNICEF, for absenteeism. First, some students really cannot attend school because of illness, family responsibility, instability in family, daily wage work, and involvement with the justice system. Secondly, some students do not attend school to avoid bullying, unsafe conditions, harassment, and embarrassment by either peers or elders. Finally, some students and their parents do not see the value in attending school, they have something else they would instead do, or nothing stops them from skipping school. The same study further presented "myths" as an additional category of absenteeism, which includes students and their families who do not realize that missing just a half day per month can be a problem (Balfanz & Byrnes, 2012). Concurrently, another study by Bowman-Perrott et al. (2013) stated that school suspension and exclusion were found as to be growing issues and were identified as major causes of chronic absenteeism. It disproportionately affects students with emotional and behavioural disorders and attention-deficit/hyperactivity disorder.

Similarly, the findings from the qualitative study revealed that poor WASH facilities in schools affect children's ability to learn in several ways. For instance, WASH-related infections may impair children's physical development and reduce their cognitive development. These diseases force many children to be absent from school. Poor school WASH facilities not only impaired students' learning environment, but also deteriorated the health of teachers and that of the families of pupils. Furthermore, the effects of the disease in teachers lead them being absent from work, which has a direct impact on learning performance. In the case of water scarcity or contaminated water, students failed to drink sufficient water and increased their

physical activity, reducing the child's ability to learn. Students drink more water, and therefore remain healthier when access to water is readily available.

An assessment by Lovegrove (2019) in Nepal found, parallel with the present findings, that the existing toilets were woefully inadequate. Consequently, children, particularly girls frequently missed school days. Similarly, Shrestha (2022) identified that 84% of girls took days off during menstruation in the past three months with an average of 2.6 days. Out of 71 students who reported soiling of dresses with menstrual blood as a common problem, 27% went back home and did not return in such a situation instead of washing off at school. Nearly two third (61%) of them gave pain as the reason, and 39% of them cited tiredness as their reason for taking days off. The study further stated that toilets and health care facilities were poor in schools, hence, a lack of these facilities in schools might be contributing to absenteeism (Shrestha, 2022).

The present study found that students' health status significantly affects students' school regularity (cOR=3.160; 95% CI; 2.585-5.042, p<0.001). Putting it another way, students with poor health status were more likely to be absent than those who have good health. This finding is similar to the findings of Joshi and Amadi (2013), as they found that among all school absenteeism, 75% are constituted by illness-related absenteeism in children. The same review highlighted that access to hand hygiene instructions and hygiene facilities improved attendance at public elementary schools during the flu season. The benefits of handwashing for school regularity were more pronounced in females (Joshi & Amadi, 2013). Uniformly, UNICEF (2015) stated that WASH in schools significantly reduces hygiene-related diseases and increases school attendance. The report further noted that WASH in schools promotes equity. All children are entitled to have equal access to WASH

facilities; all children can be benefited from improved hygiene promoted by WASH activities in schools.

Similar to the present findings, Graitcer et al. (2007) explained that poor health conditions in students are closely associated with missing school days. Similarly, Jones et al. (2009) conducted absence-related research and identified health conditions as the most common reason for students' school absenteeism, rather than school WASH facilities. Lau et al. (2012) presented findings consistent with present study, indicating that school WASH interventions, including educational components, improved the students' school regularity and educational outcomes, which is identical with the findings in Graitcer et al. (2007) and Jones et al. (2009). Another study stated that female students were relatively less likely to be absent compared to males after the school WASH intervention (Nandrup-Bus & Visitor, 2009). So, it can be concluded that reasons for absence vary among communities, geographical sites, and genders.

The present study found that students' age, sex, and religion were not statistically associated with students' school regularity. Consistent with the quantitative findings, the qualitative findings emphasized that students' participation in social and religious tasks, household responsibilities, and disinterest in attending school are leading causes of absenteeism. The qualitative findings further suggested that even though school WASH facilities seem to be prime reasons for school absenteeism, other causes should not be overlooked. Students’ attitudes toward education, their relation to the teachers, family, and social responsibilities were also reported as causes for school absenteeism. In line with the present findings, the US Civil Rights and Data Collection (CRDC) 2020-2021 stated that children with disabilities are more likely to be chronically absent than children without disabilities.

Simultaneously, children and youth with special health care needs tend to have more school absences than children without such needs (Reuben & Pastor, 2013).

Students on the autism spectrum who display disruptive behaviours at school may be more likely to be excluded or absent from school (Pas et al., 2016). The literature supports the findings of this study in terms of cases of school absenteeism: i) personal causes: poor health conditions and disorderly activities, ii) family causes: low maternal education and high levels of unemployment, iii) school causes: fear of punishment, disinterest in the teacher's lecture, iv) WASH causes, v) socio-cultural causes, and vi) students' and parental prioritization of religious activities over school. Consistent with these findings, the present study found that the economic status of the family can be a core hindrance factor for school regularity. For the girls, a lack of separate toilets with MHM rooms including other MHM facilities, sanitary materials, running water with soap, safety protection, and health facilities within schools are noted as causes of school absenteeism.

Contrary to the present findings, Kathleen (2002) stated that out of the total 804 respondents, 360 indicated that the child did not miss school due to illness, but 444 confirmed that the child missed school owing to an illness. Furthermore, out of the 444 illness episodes, 44% occurred during the non-influenza season and 56% occurred during the influenza season. Additionally, days of school missed per episode were higher during influenza season compared to the non-influenza winter season. Parents were much more likely to report an illness-related absence during the influenza season compared with the non-influenza season. Though the present study did not assess seasonal absenteeism, overall, it was more likely higher in unimproved schools compared to improved ($p<0.001$), which is in consistent with the findings by Kathleen (2002). In a similar vein, a study conducted in Egypt found cases of

laboratory-confirmed Influenza (ILI) in control and intervention schools at rates of 35% and 18%, ($p<0.01$), respectively (Talaat et al., 2011). Later, in intervention schools, students who were absent because of ILI in the control schools showed a higher rate of ILI (27%) compared to intervention schools (7%), ($p<0.01$). The intervention on handwashing at school positively impacted the students' health and absenteeism. Consistent with the present findings, Mentziou et al. (2015) concluded that handwashing facilities significantly reduced illness-related absences in elementary schools by 26%.

Consistent with the present findings, the study by Trinies (2016), Talaat et al. (2011) and Bowen et al. (2007) concluded that improved WASH services at school reduced diarrhoeal and respiratory infection and absenteeism. An impact study in the Nyanza province of Western Kenya by O'Reilly, Freeman & Hoekstra (2008) concluded that after implementing WASH services with hygiene education in primary schools, student absenteeism was reduced by 35%. The findings were consistent with evaluations of school-based hand hygiene programmes in the USA, where Guinan, McGuckin and Ali (2002) showed that reduction in absenteeism following the implementation of hand sanitizer, with hand hygiene education adjusted with these interventions. Differently, Grant, Lioyd and Mensch (2015) researched menstrual and school absenteeism using a longitudinal survey design. The study concluded that one-third of female students missed at least one day of school during their last menstrual period. However, menstruation only accounts for a small proportion of all female absenteeism. It does not create a gender gap in absenteeism, suggesting that menstruation is not sensitive to the school environment.

In the USA, the average student from K-12 misses 4.5 days per school year, while the average teacher misses 5.3 days per school year (Azor-Martinez et al.,

2014). Consequently, this result as 164 million lost school days for students per year in the USA whatever the reasons. Even though respiratory and gastrointestinal diseases are believed to be the main reasons that the students are absent from school on any day, it is not the only reason behind students' absenteeism. In other words, research indicated that the most transmitted infections in schools are respiratory and gastrointestinal diseases; both can also sicken students and cause them to be absent from school. More importantly, the research articulated that improving hand hygiene practices can reduce the potential impact of infections. Notably, the study showed that absenteeism could be reduced by 5-10% by emphasizing hand hygiene in a school through education and encouraging the use of alcohol-based hand rub (Azor-Martinez et al., 2014). A study conducted in Spain showed that students wash their hands using soap and water, and then use a rub. This study showed a 32% reduction of the students' absenteeism per academic year, suggesting that the combination of handwashing or rub may offer the most significant opportunity to reduce absenteeism.

Absenteeism in schools is a significant problem for the students. While many factors contribute to school absenteeism, students' illness is the primary driver. The transmission of pathogenic organisms within schools can result in infections making students too sick to attend classes. Diseases like influenza, the common cold, and diarrhoea are normal, and they are positively impacted by hand hygiene and route cleaning and disinfection of commonly touched surfaces.

In short, poor school WASH facilities impaired the students' school regularity; even so, other variables such as students' personal problems, perceptions, family background, socio-economic factors, school climate, and accommodation are also responsible for absenteeism.

School WASH Facilities and Sudents' Educational Achievement

This study concluded that school WASH facilities had a positive and statistically significant effect on students' educational achievement. The H1 hypothesis - students are more likely to achieve educational achievement where school WASH facilities improved- has been accepted ($p<0.001$). However, there is insufficient evidence to say that the students' age, sex, and religion had an impact on the students' educational achievements. Similarly, the qualitative findings noted poor school WASH facilities as barriers to student educational performance. In addition to quantitative and qualitative findings, variables stemming from theories such as TPB (attitude, subjective-norm, intention) and HBM (self-efficacy), all are significantly associated with the students' educational achievements. Finally, students with above average scores regarding school WASH were more likely to achieve higher scores than those students with below average scores ($p<0.001$), in all variables. However, these variables cannot be significant predictors for students' health status, school regularity, and educational achievements.

In support of the present findings, a cross-sectional study by Antwi-Agyei et al. (2017) concluded that adequate WASH services in schools, mainly drinking water and handwashing, play a crucial role in improving students' educational achievement. The authors further reported that a constant supply of drinking water throughout the year in school improves the students' academic proficiency. Consistent with the present findings, a study conducted in Zambia linked the school WASH situation (adequate and inadequate) with three educational indicators: enrollment ratios, repetition, and dropout rates, and presented a statistically significant effect of the school WASH situation, whether adequate and inadequate, on the enrollment ratio, repetition, and dropout rates ($p<0.05$). Notably, the study showed that more girls

dropped out from those schools which had poor WASH services, especially with no toilets.

In line with the present findings, UNICEF (2016) has also presented scientific evidence on the impacts of WASH in schools on pupils' health, well-being, and educational performance. Inadequate WASH affects children's health, well-being, and cognitive performance. The study undertaken by UNICEF indicates a clear association between children's health and WASH conditions in schools. The research further stated that many pupils avoid using WASH facilities, with consequences on health, well-being, and cognitive performance (UNICEF, 2016). A qualitative study conducted in Nepal found improved students' knowledge, awareness, and practices regarding health and hygiene issues after implementation of the School Health and Nutrition (SHN) programme at schools (Shrestha, Yadav & Sharma, 2018). The study further stated that better school access to hygiene and sanitation facilities due to the SHN programme could be associated with better hygiene practices and educational outcomes. Similarly, Bundy (2011) articulated that the SHN programme yielded short and long-term positive impacts on students' attitudes, practices, health, and academic outcomes worldwide. These findings are similar to the present results that the students with improved school WASH services are more likely to acquire higher grades than those from schools with unimproved WASH services.

The qualitative findings support the quantitative findings as educational achievements are impaired by the students' health status and absences whatever the causes might be. Poor school WASH can impair students' educational performance; however, we cannot overlook other subsidiary causes like teachers' expertise on the subject matter, students' relationship to the teacher, family background, and the students' personal problems and perception of education. The present findings also

relate to the findings of Gottfried (2010), who demonstrate that impaired cognitive learning and learning performance are long-term outcomes of the adverse effects of infections such as diarrhoea, worm infections, and dehydration, attributed mainly to inadequate WASH conditions. Another study showed that about 75% of all school absences are illness-related (Lau et al., 2012). Information concerning absenteeism from middle and higher-income countries showed poor academic lower social development, higher dropout rates, including poor learning performance (Abdulbari et al., 2007). In a similar way, diarrhoeal incidents in children during the first few years of their life have been shown to limit their growth by about 8cm, causing an I.Q. point reduction when they reach about 7 or 8 years of age (Guerrant et al., 2013).

Some contrasting results can be seen in the present analysis. For example, students' age, sex, and religion had no significant effect on educational achievement. Similarly, the qualitative findings also support other causes for low academic achievements such as students' participation in social and religious tasks, household responsibility, and menstruation problems in females, rather than insufficient school WASH facilities. A study in Kenya by O'Reilly, Freeman and Hoekstra (2008) illustrated that faecal contamination was high in schools because many schools had few latrines, and a limited water supply often of poor quality. The students were permitted to touch and use stored water. The schools did not have handwashing facilities. In this background, school attendance was highly impacted, and the burden of diarrhoeal diseases and parasitic infections negatively impacted students' growth, nutritional status, physical activities, cognition learning, concentration, and school performance (O'Reilly, Freeman & Hoekstra, 2008). In conclusion, the present study, as well as numerous previous studies, found that the lack of appropriate WASH

services at school hinders students' educational achievements, whether directly or indirectly.

The use of inadequate and contaminated water, and poor and unsafe sanitation facilities, impaired students' school regularity, which ultimately hurts educational performance. Besides the school WASH facilities, students' school absenteeism, whatever the causes might be, directly and indirectly hindered their educational performance. Along with this, the qualitative study concluded that the teacher's expertise on subject matter; teachers' and students' relationship, and students' interest in education are the significant determining factors for educational achievements.

School WASH Facilities' and Students' Health Status, School Regularity, and Educational Achievement

The present study illustrated that the students with improved school WASH facilities were less likely to have sickness (cOR=0.388; 95% CI; 0.290-0.519, $p<0.001$) than those from unimproved schools. Consistent with the present study, a study conducted by Vally et al. (2019) in the Philippines using multivariate analysis stated that intervention in school WASH facilities reduced students' illness. Though intervention on school WASH facilities reduced sickness, the effect was not significant ($p=0.29$), meaning that there was insufficient evidence to claim that school WASH facilities have an effect on sickness levels (Vally et al., 2019).

Equally, students' health status (aOR=0.509; 95% CI; 0.343-0.756, $p<0.001$) including self-efficacy (aOR=0.511; 95% CI; 0.327-0.800, $p<0.01$), sex (aOR=1.562; 95% CI; 1.146-2.130, $p<0.01$), and caste (aOR=2.057; 95% CI; 1.248-3.392, $p<0.01$) remained statistically significant after the inclusion of all theory-based variables and socio-covariates. In support of the present findings, a study by Shrestha, Vicendese and Erbas (2020) found in Nepal that WASH practices are associated with improved

height-for-age, weight-for-height, and weight-for-age among under-five children. The researchers used a multivariate linear regression to understand the association between heights for age, weight for height and weight for age z scores and WASH variables. The research found that sanitation coverage was associated with weight for age, 0.30, 95% CI, 0.12-0.48, height for age, 0.28, 95% CI, and 0.001-0.56. Similarly, household water purification practice was associated with an increase of 0.24; 95% CI; 0.07-0.41 in the weight for height score. Additionally, handwashing with water and soap was associated with an increase of 0.15 95% CI; 0.04-0.25) for age and water for height was 0.13 (95% CI; 0.01-0.24). Finally, the research showed that water purification practices was higher in rural areas than urban settings p=0.02 (Shrestha, Vicendese & Erbas, 2020).

The result also showed that students from schools with improved WASH facilities were more likely to be regular attendees (cOR=2.802; 95% CI; 2.033-3.862, p<0.001) than those who did not have improved WASH facilities at school. Consistent with the present findings, a study conducted in the Philippines using multilevel modeling revealed that the intervention in school WASH reduced students' illness-related absences in a statistically significant way (p<0.001) (Vally et al., 2019). In a similar way, Sivakami et al. (2019) carried out a study on menstruation in girls and their schooling. Facilitators of MHM in schools in India in 2015 indicate a significant impact on school attendance in model and regular schools at various levels, for instance, the effect of school attendance is significant (p<0.01), concentration (p<0.01), menstruation pain (p<0.001), and fear of stain or smell, (p<0.01) (Sivakami et al., 2019). Equally, the present study showed that school WASH facilities significantly affected students' school regularity (aOR=2.503; 95% CI; 1.798-3.484, p<0.001). Students' self-efficacy on school WASH was the

significant predictor (aOR=1.572; 95% CI; 1.038-2.381, p<0.05) of school absenteeism even after the inclusion of three variables: attitudes, self-efficacy, and subjective norms, keeping constant other socio-covariates. Similarly, unimproved school WASH facilities were statistically significant predictors for students' school absenteeism (aOR=2.462; 95% CI; 1.766-3.43, p<0.001) after the inclusion of all theory-based variables and other socio-covariates in the same model.

This research found that there was no statistically significant association between school absenteeism and age groups: 10-14 and >15 years. Consistently with the present study, research confined by Munn et al. (2020) stated that absenteeism for any reason was very low-certainty evidence for children aged between five to 14 years (IRR=0.91; 95% CI; 0.82-1.01). The research further stated that absenteeism for any illness, (the pooled IRR was 0.82; 95% CI; 0.69-0.97) was found to be very low-certainty evidence. The authors further noted that rinse-free hand washing is not a significant predictor for absenteeism. There is no significant difference in absenteeism between two groups of children; rinse-free handwashing and no rinse-handwashing groups. In the same way, there was insufficient evidence to state that the effect on absences due to ARI, Acute Gastrointestinal Illness (AGI), and skin reactions from rinse-handwashing was statistically significant. The intervention showed very low-certainty evidence on compliance in the same study (Munn et al., 2020).

Simultaneously, the students with unimproved school WASH facilities were more likely to be absent (aOR=1.616; 95% CI; 1.047-2.497, p<0.05) compared to the improved ones. Grade eight students were more likely to have been absentees (aOR=0.591; 95% CI; 0.355-0.984, p<0.05) than grade six and seven grade, and Brahmin/Chhetri-Terai (aOR=0.524; 95% CI; 0.314-0.881, p<0.05), Dalit (aOR=0.300;95%CI; 0.174-0.516, p<0.001), and other caste (aOR=0.342; 95% CI;

0.164-0.713, p<0.01) were more likely be absent compared to the students belonging to other castes; Brahmin/Chhetri-Hill and Janajati after the inclusion of other socio-covariates and TPB and HBM variables.

The results show that the students from improved WASH facilities at school were more likely to score a B/B+ or higher (cOR=2.769; 95% CI; 2.062–3.720, p<0.001) than those who were from schools with unimproved WASH facilities. The students with improved school WASH have higher educational achievements (B/B+ grade) (aOR=2.753; 95% CI; 2.028-3.737, p<0.001) than students in unimproved schools, after adjusting for theory-based variables. Furthermore, the students with above average subjective norms on school WASH behaviour were more likely to obtain higher academic achievements (aOR=1.528; 95% CI; 1.065-2.192, p<0.05) compared to the students having average or below average subjective norms after the inclusion of TPB and HBM variables and keeping constant the other co-covariates in the same model.

Equally, the improved school WASH facilities constituted a significant predictor for students' educational achievement (aOR=2.702; 95% CI; 1.988-3.672, p<0.001). Equally, the students with above average subjective norms on school WASH behaviour were more likely to get higher educational achievements (B or above) (aOR=1.478; 95% CI; 1.027-2.127, p<0.05) after adjusting for all TPB and HBM variables and keeping all socio-characteristics constant in the same model. The students' educational achievement was statistically significant after adjusting all socio-covariates and theory-based variables in school WASH facilities (aOR=8.312; 95% CI; 5.082-13.597, p<0.001). Similarly, the female students were more likely to obtain higher educational achievements (aOR=0.694; 95% CI; 0.495-0.972, p<0.05), and students in grades seven and eight were more likely to obtain higher educational

achievements (aOR=4.427; 95% CI; 2.725-7.190, p<0.001) and (aOR=7.659; 95% CI; 4.441-13.307, p<0.001), respectively. Additionally, Janajati students were more likely to obtain higher academic achievements (aOR=0.473; 95% CI; 0.249-0.900, p<0.05) compared to the students belonging to other castes.

Students', Teachers', and Parental' Perception on Students' Health Status, Regularity, and Educational Achievements by School WASH Facilities

This objective deals with the qualitative information obtained from the students, teachers, head teachers, and parents. The study found that school WASH facilities act as one of the leading causes for the student's health status. More than that, the research found that the different ways of handling WASH services remained equally crucial to the availability and sufficiency of school WASH facilities for students' health. Consistent with the present findings, a review performed by McMichael (2019) in LIC states that school-based WASH programs reduced illnesses in students. Similarly, a study conducted in rural Tanzania found that handwashing with soap at school through WASH programmes can reduce disease in school-aged children, thereby reducing absence from school (Hetherington et al., 2017). A review conducted by Esrey et al. (1991) concluded that access to improved WASH yielded more significant reductions in diarrheal disease than interventions involving water quality. Consistent with these findings, sanitation and water supply interventions have largely dominated the cases of disease while focusing on diarrhoeal disease prevention. A systematic review performed by Joshi and Amadi (2013) explored the significant impact of water treatment, hygiene, and sanitary interventions on improving child health outcomes.

Similarly, research in Mali and India demonstrated a high impact from WASH behaviour because it consisted of Community-Based Total Sanitation (CBTS), a

practical WASH promotion approach to empower and develop ownership for better behavioural change. It ultimately decreases the frequency of infections (Pickering et al., 2015; Patil et al., 2014).

A cluster-randomised study by Dreibelbis et al. (2014) examined the impact of school WASH interventions on diarrhoea-related outcomes among younger siblings of school-going children. Equally, in the present findings, schools with improved WASH facilities were found as the pull factors, especially for menstruation-aged girls, whilst schools with unimproved WASH facilities remained push factors for the students. Pull factors in these scenarios are factors that enable schools to attract pupils to attend and push factors are factors that make students choose not to enroll in school, or to withdraw from school. Besides this, students' engagement in social and religious tasks, household responsibilities, a lack of interest in going to school, and fears of punishment all equally increased both girls’ and boys' school absenteeism. These causes have been neglected in much of the literature. The researcher found that MHM facilities and materials such as separate rooms, water management in toilets, soap, and pads can significantly increase girls' participation. Supporting the present findings, a study by McMichael (2019) concluded that school WASH conditions might reduce girls’ absenteeism by providing MHM facilities.

Another review carried out by Munn et al. (2020) is consistent with the present findings. Accordingly, absenteeism has multiple reasons and there was insufficient evidence to claim the exact causes of school absenteeism. The study further stated that absenteeism from any illness has no strong evidence. A qualitative study conducted by Kansiime et al. (2020) in Uganda showed that anxiety about the next period decreased by about 14 percentage points from 58.6% to 34.4%, and the use of effective pain management increased from 76.4% to 91.4%. Similarly, the study by

Kansiime et al. (2020) reported that an intervention on school WASH impacted on improving MHM-related school absenteeism. After the intervention, the study found that school absenteeism due to menstruation was reduced relative to other reasons.

An analysis performed by UNICEF in 2016 highlighted MHM-related absenteeism in the Acham, Bajura, and Parsa districts of Nepal. The research stated that MHM for schoolgirls has long been a neglected issue in the country. Women and girls continue to face many challenges due to their gender and school attendance. Girls often struggle to manage their menstruation hygiene in schools, causing school absenteeism in adolescent girls. The findings of this study are in the same vein as the present findings in that some girls in unimproved schools dropped out due to menstruation and the unavailability of the pads at schools. In such a situation, the students need to manage pads themselves when their menstruation period is approaching.

The same research from UNICEF reported that school toilets were often not clean or private, so most of the girls did not change their products or use the toilets at school. Girls who left school to go home to change usually remained at home and did not return to school that day. Similarly, almost half (45%) of female respondents felt uncomfortable sitting in the front row of their classes during their menstruation period. Further, some (15%) of girls in WinS schools and one in five (21%) in non-WinS schools reported that they would never raise their hand to answer questions. The school-aged girls faced many challenges like shame, fear, confusion, teasing, and lack of accurate information and support related to menstruation. As a result, many girls cannot effectively manage their menstruation. Additionally, there are some prevailing harmful socio-cultural restrictions, as well as practical factors, including

shortage of soap and water, sanitary products, and sanitation and waste disposal facilities in school environments which hinder the girls' educational achievements.

The same study further stated that the mixed-gender classes were problematic because SRH classes were not taught in classes; rather, students were asked to self-study. The MHM classes focused on cleanliness for preventing diseases rather than being responsive to the girls' queries. One third (32%) of girls in WinS and 43% in non-WinS schools would never write on the board while menstruating. Half of the girls reported difficulty concentrating in their classes due to discomfort, pain, and fear of leakage. Besides this, most of the girls in both types of school felt uncomfortable participating in sports and classes with boys (UNICEF, 2016). The present research concludes that WASH facilities in both hardware and software are crucial for the educational achievements of students. The improved WASH facilities enhanced educational outcomes. On the other hand, poor school WASH facilities hindered the students' learning outcomes and deteriorated the teachers' performance. Peer teaching, especially in specific health issues such as WASH, MHM, sexual and reproductive health were more likely to yield good educational results.

Strengths and Limitation of the Study

A unique strength of this PhD. dissertation is that it is an adequate assessment of school-based WASH facilities, combining improved and unimproved WASH facilities and including 768 quantitative respondents and 32 qualitative participants. Secondly, it involves mixed-methods research and causal comparative/ex-post facto research design, controlling for several critical matching variables from the non-experimental designs of this study. Thirdly, it applies three sorts of statistical analysis: i) univariate; to show the respondents demographic background, ii) bivariate; to show

the association between two variables, and iii) multivariate; to show the effects among research variables.

In a truly scientific spirit, the researcher would like to disclose the known limitations of this PhD. dissertation. Primarily, the researcher obtained self-reporting information from the respondents, however these were verified by school records. Nonetheless, the underreporting of sickness, school attendance, and educational achievements might have information bias. Secondly, the students from the same school WASH facilities have a different health status depending on the home environment, and WASH handling, food consumption, and family economic status might not have been adequately addressed as causes. The differential interest of students may have contributed to the low rate of attendance and poor educational achievements. Moreover, the students may attend tuition classes, which may cause higher academic achievements that may differentiate educational achievements of students within the same and other schools, was overlooked in this dissertation.

The prevalence of disease, defined six months before the study period, including only WASH-related diseases, may have been overestimated if a child were sick at the beginning of subsequent months and beyond the WASH-related diseases. Similarly, absence incidence was defined as ≥1 day of absence in six months during the study period; it was overestimated if a child left school in half day or had been sick before six months. Such over estimation is unlikely to have occurred differentially between the improved and unimproved schools.

The relatively single-phase and short study duration may have also led to over estimating effects, as respondents may have been more likely to adhere to the new WASH effect over a shorter period. Further, it was not designed to measure the sustainability of effect. As this research work applied a causal-comparative research

design, it has the same limitation as any other design under non-experimental study that cannot manipulate the independent variables. The researcher has no control over the variables that can impact on the dependent variable. In addition, it is impossible to choose the experimental groups since the events have already been occurred (Salkind, 2010).

CHAPTER VI

Conclusions and Implications

This chapter presents the conclusion as well as the implications of the study and contributions of the dissertation. First, the researcher concludes by presenting the main findings of the study, followed by their implications. In doing so, the quantitative conclusions are supported or differentiated by qualitative conclusions and are linked with TPB and HBM theories.

Conclusions

By triangulating across several quantitative, qualitative, and theoretical datasets, this study has provided unique insights into correlations and potential mechanisms behind the association between school WASH and multidimensional effects on their health status, school regularity, and educational achievements. In the following discussion, the researcher asserts core understandings gained from the dissertation.

Primarily, school WASH facilities have a strong association with students' health status. The schools with improved WASH facilities enable students' health status, whereas unimproved schools deteriorate that status. In addition, the gender and ethnicity of the students have a strong association with the student's health status. Furthermore, theoretical variables such as HBM (self-efficacy) and TPB (attitude, subjective-norms, and intention) are associated with to school WASH effects students’ health status. Students with average or below average scores on the mentioned theoretical variables on school WASH are sicker than those students with above average scores. Improved school WASH facilities are the determining factor for the students' health status, even after adjusting for both TPB and HBM variables, as well as other socio-demographic variables. Even so, students' health status cannot

be predicted based solely on their attitude, subjective-norms, self-efficacy, and intentions regarding school WASH facilities. So, schools' poor WASH facilities impaired students' health status, however, ways of managing these facilities are equally important to the availability and sufficiency.

Secondly, improved school WASH facilities increase students' school regularity. The students belonging to the improved schools attend more regularly than those from the unimproved schools. Equally, students are more absent from school when they have average or below average scores on variables stemming from theories such as HBM (self-efficacy) and TPB (attitude, subjective-norms, and intention) compared to the students with above average scores. Moreover, students are more likely to be absent when they attend schools with unimproved WASH facilities, after adjusting for the mentioned theoretical variables and other socio-covariates. Though students' attitudes, subjective-norms, self-efficacy, and intentions are closely associated with school regularity, the researcher cannot claim that they all are determinant factors for the students' school absenteeism. Though students' school regularity is impaired by unimproved school WASH facilities, it is equally affected by several factors such as students' problems, personal perceptions, family background, socio-economic factors, school environment, teacher-student relationships, and accommodation. For the girls, separate sanitation facilities including MHM rooms with safety measures, cleaning materials, sanitary pads, running water, and soap are pre-requisites for improving their attendance during the menstruation period.

Thirdly, school WASH facilities affect students' educational achievements. Students who belong to the improved school WASH facilities achieve higher educational achievements than those of students who study in unimproved WASH schools. In the same way, students' attitudes, subjective norms, self-efficacy, and

intentions have a close association with educational achievements. Students with above average scores on attitude, subjective-norms, self-efficacy, and intentions achieve higher educational outcomes compared to the students with below average scores on those variables. School WASH facilities are a significant predictor for educational achievements, even after adjusting for TPB and HBM variables and socio-demographic variables. So, it can be said that the students with access to unimproved school WASH facilities have lower educational achievements than students studying in improved schools. Though these variables are closely associated with students' educational achievements, they are not determinants for educational achievements. In other words, these variables are not predictors for the students' low educational achievements. The researcher agrees that schools with poor WASH facilities directly and indirectly impair students' educational achievements. More than that, learning outcomes are impaired by several other causes like students' family background, students' problems, personal perceptions, relations with the teachers, teacher's quality, and family responsibilities.

Finally, the researcher concluded that school WASH facilities are a crucial aspect for students' better health, regular attendance, and better educational achievements. The WASH services should be improved in terms of quality and accessibility to all ages and disabilities. Sanitation facilities require separate provisions for girls including MHM facilities with safety measures, MHM materials, sanitary pads, and cleaning materials. Besides, the schools should be equipped with fixed handwashing facilities with running water and handwashing materials. To do so, a proper collaboration between and among schools, WASH sectors, communities, and local government is essential. It further enables the elimination of WASH-borne diseases and school absenteeism and improves students' educational achievements.

Further collaboration is needed between schools and WASH sector stakeholders, disease control programmes, and local government for making a shared vision to work against disease, absenteeism, and low educational achievements in schools.

Based on these conclusions, the researcher argues that it is worthwhile to maintain and construct new WASH facilities at schools, and to consider them fundamental human rights. Equal access should be given to all the students to WASH facilities; they should be considered as part of the right to education for every citizen. Going to school and passing through grades, as usual, is not the same as gaining knowledge in a healthy environment, including life-long health skills and exhibiting higher academic performance. So, the researcher suggests that scholars emphasize WASH facilities in academic institutions, and that professionals pay attention to WASH services at schools. The willpower and social pressure can be the keys to promote individual, institutional, and social change. Through this framing, institutions (such as schools), LGs, and Development Agencies (DAs) can be prompted to take the sole responsibility to address WASH deficiency at schools.

Eventually, this PhD. dissertation found that school WASH facilities jointly effects health status, school regularity, and educational achievements in basic level students, even after adjusting for attitude, subjective norms, self-efficacy, and intentions. However, these variables are not the predictors of health status, school regularity, and educational achievements. The present study is equally important for the below four aspects.

First, this PhD. dissertation will add the value to the body of knowledge in the academic level. Secondly, it will enable the three tiers of government: central, provincial, and local levels' policy makers and implementers to make wise decisions while formulating school-based WASH plans. It will further facilitate organizations

who are working with WASH sectors with formative as well as guiding research. Thirdly, on a practical level it will be beneficial to all concerned people by identifying how the existing school-based WASH facilities impacts students' health status, school regularity, and educational achievements. In addition, the research raised an awareness that enhanced initiatives for reducing the causes of illness, absenteeism, and poor educational achievements.

Implications

As reported in chapters IV and V, and summarized in the previous section, the study's conclusion has several implications: theoretical, methodological, and practical, which are as follows:

Theoretical Implications

The HBM can be taken as a conceptual framework for health behaviour. The model can be further applied for change and the maintenance of health-related behaviour. The guiding framework for health behaviour interventions can be formulated for better achievement. In a similar way, the TPB can be used for predicting changes in individuals' health behaviour in the future.

As discussed above, this study connects quantitative associations with qualitative experiences, shedding light on the theoretical connections to TPB and HBM that could assist in predicting the students' health status, school regularity, and educational achievements. It has further shown that the students' health status, school regularity, and educational achievements can be predicted and explained by their attitudes, subjective-norms, self-efficacy, and intention. Furthermore, the findings of the current study yielded a significant insight regarding the ability of TPB and HBM to explain a mechanism for identifying factors that can be helpful for predicting behavioural intentions and status towards WASH between the two groups of schools:

those with and without improved WASH facilities. By doing so, it contributes to policy and theory in several ways.

More importantly, based upon the current findings, TPB and HBM can be applied as a theoretical framework for predicting behavioural intentions towards a variety of WASH behaviours and their implications on health status, school absenteeism, and educational achievements properly. The present study found that attitudes emerged as a significant predictor of students' behavioural intentions and health, absenteeism, and educational achievements, followed by subjective-norms and self-efficacy. The findings show that students with improved school WASH facilities have been more likely to feel positively about WASH intentions. Theoretically, this indicates that the TPB and HBM do not operate in the same way for all students' health status, school regularity, and educational achievements; it may be different and contextual. There may be several variables influencing students' health status, school regularity, and educational achievements. In addition, it shows that the attitude, subjective-norms, and self-efficacy cannot explain all the determinants of behavioural intentions which may limit predictive accuracy.

This study uses TPB and HBM as a theoretical framework for the investigation because several kinds of earlier research work applied these variables: attitudes, self-efficacy, and subjective-norms to predict behavioural intentions. However, I would like to suggest that besides these, other supplementary predictors seem to be required in the TPB and HBM model that can strengthen the model's validity. While the findings of this study indeed point to the value of school WASH facilities towards students' health status, school regularity, and educational achievements, the implications apply in other areas.

Methodological Implication

Mixing two research methods is superior to a single method as it provides rich insight into the research phenomena that cannot be fully understand by using either qualitative or quantitative methods. A mixed-methods design can integrate and synergise multiple data sources which can assist in remarkably complex tasks. The implication of mixed-methods research lies in purposeful data merging that allows researchers to seek a wide view of their study by enabling them to view a phenomenon from different perspectives. There are four major mixed-methods implications that were applied in this PhD. dissertation.

The first implication of this mixed-methods research is the expansion of the study. This approach allows researchers to widen their inquiry with sufficient depth and breadth. For instance, if a researcher wants to generalize the findings to a school WASH facility, students' health status, school regularity, and educational achievements, obtaining detailed associations as well as effects between and among variables, collecting closed-ended quantitative data is beneficial to understand a research problem. Simultaneously, open-ended qualitative data provides in-depth insight into the research inquiry as the researcher can gain a deeper insight into the variables from narratives.

The second implication of mixed methods is that both kinds of research have values and that in some respects they are complementary, and therefore, there will be an added value in combining them. This implies that a quantitative method can be strong in some areas where a qualitative method is weak. So, mixing the two methods, therefore, offers the possibility of combining two sets of strengths while compensating at the same time for the weakness of each method. The researchers can use both data sets to answer the same research question which can produce greater

certainty and wider implications. Additionally, its implication is to understand a more complete picture of the phenomenon that is valuable, as they lead to extra reflection and enrich our understanding of a phenomenon.

The third implication of this method is its triangulation component. Researchers can imply data triangulation, methods triangulation, source triangulation, and theory triangulation as strategies for validating results obtained from the various sources. It further opens a more valid picture about a research issue by directly comparing the findings drawn from one method to those obtained from another for convergence and or divergence. So, triangulation can be applied to develop a well-validated and refined conclusion that eventually promotes the credibility of inferences obtained from one approach.

Practical Implications

The dissertation has several important implications for the individuals, schools, local governments, and other organizational levels. The prominent implication of the present dissertation is on interventions on hardware and software in households and different organizations, especially in schools. The hardware denotes all WASH infrastructures, whereas software concerns the school environment. Everyone in the organization can utilise the findings of this dissertation in their day-to-day life, though some overarching areas are as follows:

Individual. All people can benefit from the findings of this dissertation in the sense that adequate WASH facilities and their proper utilization are essential to be free from WASH-borne diseases. Furthermore, they may be aware of the individual and family levels of WASH behaviour which are directly associated with their child's regular attendance and higher educational performance. Besides, they will also be aware of how individual perceptions like attitudes, subjective-norms, self-efficacy, and intentions towards WASH facilities impaired their health status, school

attendance, and educational achievements. Later on, they will educate their child accordingly.

Schools. Schools can apply the findings of this dissertation by promoting hygiene and cleanliness in schools to protect students and school families from WASH-related diseases. Schools can improve the attendance of the students by providing safe drinking water to children of all ages and those with disabilities. Furthermore, schools' sanitation facilities and hygiene practices can improve and be made safe and useable without any stink and include running water and handwashing materials. School WASH facilities can be set up in the schools. Further, the schools can construct separate sanitation facilities including MHM rooms, MHM materials and sanitary pads, running water, and other required materials for the girls during their menstruation period. By managing school WASH needs, and enrolling quality teachers, schools can foster higher educational achievements of the students.

Local Government. It is crucial to investigate the major hindrance factors towards students' sickness and educational performance. From the findings of this dissertation, the school and local government can jointly develop a shared vision to make disease-free schools and communities, and to promote higher educational performance. To do so, a proper collaboration between and among schools, WASH sectors, communities, and local government is essential. It further enables the elimination of WASH-borne diseases and school absenteeism and improves students' educational achievements. Further collaboration is needed in schools with WASH sector stakeholders, disease control programmes, and local government for developing a shared vision to fight disease, absenteeism, and low educational achievements in schools. Lastly, local, provincial, and federal governments will benefit from the WASH policy formulation, especially in schools.

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APPENDIXES

Appendix A. NHRC Approval Letter

Government of Nepal

Nepal Health Research Council (NHRC)

Estd. 1991

Ref. No.: 3135

Date: 16 May 2021

Mr. Mohan Kumar Sharma
Principal Investigator
Tribhuvan University, Kritipur, Kathmandu

Ref: Approval of thesis proposal

Dear Mr. Sharma,

This is to certify that the following protocol and related documents have been reviewed and granted approval by the Expedited Review Sub-Committee for implementation.

ERB Protocol Registration No.	854/2020 PhD		**Sponsor Protocol No**	NA
Principal Investigator/s	Mr. Mohan Kumar Sharma		**Sponsor Institution**	NA
Title	Effect of Water, Sanitation and Hygiene Facilities On Health, Regularity And Achievement of Basic Level Students			
Protocol Version No	NA		**Version Date**	NA
Other Documents	1. Data collection tools 2. Acceptance letter from the study sites 3. Assent form		**Risk Category**	Minimal risk
Study Team Member	1. Prof. Ramesh Adhikari			
Expedited Review	Proposal	√	**Duration of Approval** 16 May 2021 to 16 May 2022	**Frequency of continuing review**
	Amendment			
	Re-submitted			
	Meeting Date: 13 May 2021			
Total budget of research	**NRs 80,000.00**			
Ethical review processing fee	**NRs 5,000.00**			
Investigator Responsibilities : • Any amendments shall be approved from the ERB before implementing them				

Tel: +977 1 4254220, Fax: +977 1 4262469, Ramshah Path, PO Box: 7626, Kathmandu, Nepal
Website: http://www.nhrc.gov.np, E-mail: nhrc@nhrc.gov.np

Government of Nepal

Nepal Health Research Council (NHRC)

Estd. 1991

Ref. No.:

- Submit progress report every 3 months
- Submit final report after completion of protocol procedures at the study site
- Report protocol deviation / violation within 7 days
- Comply with all relevant international and NHRC guidelines
- Abide by the principles of Good Clinical Practice and ethical conduct of the research

If you have any questions, please contact the Ethical Review M & E Section at NHRC.

Thanking you,

Dr. Pradip Gyanwali
Member-Secretary
(Executive Chief)

Tel: +977 1 4254220, Fax: +977 1 4262469, Ramshah Path, PO Box: 7626, Kathmandu, Nepal
Website: http://www.nhrc.gov.np, E-mail: nhrc@nhrc.gov.np

Appendix B. Survey Questionnaire

		Personal Information (PI)			
	S. N.	Questions	Responses	Code	Remarks
1.	PI1	District	Dhanusha Chitwan	1 2	
2.	PI2	Province	Bagmati province/Province 3… Madhesh Province/Province 2..	1 2	
3.	PI3	Local Level where school is located	Janakpur-submetropolitian city, Dhanusha…….. Ratnanagarmetropolitian city, Chitwan ……. Kalika municipality, Chitwan …	1 2 3	
4.	PI4	Name of the school	Shree Sankat Mochan Dev Sharan Higher Secondary School, Janakpurdham Dhanusha …… Shree Janata Madhimak Bidhaliya Shivepur, Janakpurdham Dhanusha … Shree Janajriti Higher Secondary School, Ratnanagar Chitwan ….. Shree MadhimakBidhaliya Redcross Gram, Kalika Chitwan…….	1 2 3 4	
5.	PI5	School's level	1-10 …….. 1-12 Secondary ……	1 2	
6.	PI6	Name of the student			
7.	PI7	Caste/Ethnicity			
8.	PI8	Religion			
9.	PI9	Gender	Male …….. Female ……. Others ……..	1 2 3	
10.	PI10	Age completed	…….		
11.	PI11	Grade standard	Grade 6 …… Grade 7 …… Grade 8 ……	1 2 3	
	Knowledge towards Water, Sanitation, and Hygiene (KWASH)				
	Knowledge towards Water (KW)				
12.	KW1	What are the sources of drinking water at your school?	Deep-boring…… Tube well/hand pump….. Bottle/Jar water…… Pipe/tap water …… Others …….	1 2 3 4 5	

13.	KW2	To your knowledge, what are the water purification/treatment methods? (Multiple response)	Filtration ……. Boiling …… Chlorination …… SODIS…… … Others (Specify) ……. Do not know ……	1 2 3 4 5 6	
14.	KW3	To your knowledge, why it is important to purify/treat water before drinking? (Multiple response)	It kills germs …….. It is safe to drink ……. It protects from diarrhoeal infection …… It makes testy…… Others (specify)……. Do not know …….	1 2 3 4 5 6	
	Knowledge towards Sanitation (KS)				
15.	KS1	To your knowledge, why human feces disposed properly? (Multiple response)	To be clean ..…… To protect for being water & soil pollution……. …… To protect environment from pollution…….. ……. To be free from bad smell…….. Do not know ……..	1 2 3 4 5	
16.	KS2	In your opinion, why is it important to clean anal?	Health purpose ……. Smell purpose …… Status in family/community. Not good to be not clean... Other (specify) …….	1 2 3 4 5	
17.	KS3	What material do you use for anal cleaning?	Water ……. Paper/leaf (green/dry) ……. Do not do anything …….. Other (specify) ……	1 2 3 4	
18.	KS4	What materials do you use for teeth cleaning (Multiple response)	Tooth paste & water …… Herbal plant & water…….. Water only…… Other (specify) …….	1 2 3 4	
19.	KS5	What materials do you use for bathing?	Soap & water …….. Water only …… Other specify …….	1 2 3	
	Knowledge towards Hygiene (KH)				
20.	KH1	To your knowledge, which is the appropriate time to wash your hands? (Multiple answer)	After touching garbage & animal……. After coughing & sneezing..... Whenever they look dirty … Before and after contact of sick person…….. After using toilets …… Before preparing meal …… Before eating …	1 2 3 4 5 6	

			Others (Specify)…….	7 8	
21.	KH2	To your knowledge, why is it important to wash your hands using water and soap? (Multiple answer)	To reduce the chances of getting dirrahoeal infection … To reduce the chances of getting other infection ….. Keep hands clean …… To reduce stomach ache from religious beliefs …… Other (Specify) ……	1 2 3 4 5	
22.	KH3	To your knowledge, how can you protect yourself from getting sick? (Multiple answer)	Eating fresh & washed fruits and vegetables …… Eating non-contaminated & unpolished food …….. Using clean toilet ……. Drinking cleaned & purified water……. Washing hands after playing.. Washing hands before & after eating…….. Washing hands after using toilet….. Other (specify) ……	1 2 3 4 5 6 7 8	
	Attitudes towards Water, Sanitation, and Hygiene (AWASH)				
	Attitude towards drinking Water at school (AW)				
23.	Aw1	My school's drinking water is potable.	Strongly disagree …… Disagree ……. Neutral …….. Agree ……. Strongly agree ……	1 2 3 4 5	
24.	AW2	My school's drinking water point is accessible to all students. (physically & visually disable and small children)	Strongly disagree …… Disagree …….. Neutral …….. Agree ……. Strongly agree……	1 2 3 4 5	
25.	AW3	Water purification is essential before drinking at my school.	Strongly disagree …… Disagree …… Neutral …….. Agree ……. Strongly agree……	1 2 3 4 5	
26.	AW4	Water in my school is sufficient for drinking and other purposes.	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	
	Attitude towards Sanitation at school (AS)				

27.	AS1	My school has separate and sufficient toilets for both boys and girls.	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	
28.	AS2	My school's toilets are useable.	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	
29.	AS3	I feel comfortable using school toilets during menstruation. (Girls only)	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	
30.	AS4	My school has separate toilets for girls and differently able students.	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	
31.	AS5	My school's toilets are clean.	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	
32.	AS6	I think human feces and excreta should be disposed in separate places instead of left openly in nature.	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	
33.	AS7	I think hands should be properly washed with water and soap after using latrines.	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	
34.	AS6	I think it is essential to wash anal after using a toilet.	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	
	Attitude towards hygiene at school (AH)				
35.	AH1	I think my school has good handwashing station with soap and water.	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	

36.	AH2	I think my school has accessible handwashing station with soap and water for all students. (physically & visually disable and small children)	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	
37.	AH3	I think we may catch infectious diseases if we do not wash hands with soap & water properly.	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	
38.	AH4	I think the appropriate time for the handwashing is before eating and after using toilet.	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	
39.	AH5	My school has proper management of garbage (solid & liquid)	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	
40.	AH6	My school has proper management on a menstruation (separate room, availability of pad, and pain killer medicine). (Girls only)	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	
	Subjective norms				
41.		My friends think that I use toilet properly.	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	
42.		How many of your friends think that you use toilet properly.	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	
43.		My teacher thinks that I can use toilet properly.	Strongly disagree ……. Disagree …….. Neutral ……..	1 2 3	

			Agree…… Strongly agree……	4 5	
44.		My friends think that I and my girl friends can use school toilets comfortably during menstruation. (Only for female)	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	
45.		How many of your teacher thinks that you should use toilet properly.	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	
46.		My teacher thinks that I can wash hands with soap and water applying seven steps and 20 seconds.	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	
47.		My friends thinks that I can wash hands with soap and water applying seven steps and 20 seconds	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	
	Self efficacy				
48.		I believe that I am able to purify the water before drink.	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	
49.		I believe that I can use latrine properly.	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	
50.		I believe that I can wash hands using soap and water with seven steps and 20 seconds	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	
51.		I believe that I and my girl friends can use toilet properly	Strongly disagree ……. Disagree …….. Neutral …….. Agree……	1 2 3 4	

		during menstruation (Only for girls)	Strongly agree……	5	
	Intentions				
52.		I am keen on drinking clean and pure water.	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	
53.		I desire an equal access to all students (physically & visually, and small children) in school tap.	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	
54.		I intend to defecate human feces only in toilets.	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	
55.		I intend that all of my school friends use toilets for defecation.	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	
56.		I am keen on that I and all of my girlfriends would use toilets during menstruation (only for female)	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	
57.		I am keen on washing hands using soap and water by 20 seconds applying seven steps	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	
58.		I am interested in using soap and water during bath.	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	
59.		I am interested in using dantamanjan/toot h paste/ jadibuti (herbal) while cleaning teeth.	Strongly disagree ……. Disagree …….. Neutral …….. Agree…… Strongly agree……	1 2 3 4 5	

60.		I intend to keep my school clean and healthy.	Strongly disagree …….	1	
			Disagree ……..	2	
			Neutral ……..	3	
			Agree……	4	
			Strongly agree……	5	
	Practices towards WASH at school				
	Practice towards drinking Water (PW) at school				
61.	PW1	How do you usually drinking water at your school?	By hands ……..	1	
			Directly by mouth under tap…	2	
			Plastic cups shared with other students …….	3	
			Cups shared with other students……	4	
			Shared bottles ……	5	
			Own cups ……..	6	
			Own bottle……..	7	
			Other (specify) ……..	8	
62.	PW2	If answer is by hands or directly by mouth under tap, have you wash your hands before drinking water.	Yes ……..	1	
			No …….	2	
	Practice towards Sanitation (PS) at school				
63.	PS1	Where do you usually defecate while you are at your school?	At school toilet ……..	1	
			Toilet, off school premises…	2	
			Open defecate ……..	3	
			Other (specify) …….	4	
64.	PS2	What do you usually use for anal cleaning?	Toilet paper …….	1	
			Water only…….	2 3	
			Green leaf/normal paper …	4	
			Other (specify) …….		
65.	PS3	Do you wash your hands at school?	Yes ……	1	
			No …….	2	
66.	PS3a	If yes, where do you wash your hands at your school?	Certain washing places …….	1	
			Anywhere within school yard…	2 3	
			Other (specify) …….		
67.	PS3b	If yes, what do you use to wash your hands at your school?	Water only ……	1	
			Both (water & mud/ash) …	2	
			Both (water & soap) …….	3	
			Other (specify) ……	4	
68.	PS3c	If yes, when do you wash your hands at your school?	Before & after eating ……..	1	
			After using toilet ……..	2	
			After playing ……..	3	
			Other specify ……..	4	

69.	PS4	If no, what are the reasons for not washing hands at your school?	Unavailability of soap ……..	1	
			Unclean wash basins……..	2	
			Girls are washing hands……	3	
			Boys are washing hand……	4	
			Handwashing station is out of order…..……	5	
			Crowded ……	6	
			Inadequate water …….	7	
			Far from class room ……	8	
			Too high to reach ……	9	
			Other (specify) …….	10	
	Practice towards Hygiene (PH) at school				
70.	PH1	When do you normally wash your hands at school?	After using toilet/defecating …	1	
			Before & after eating ……	2	
			After playing game ……	3	
			Other (specify) …….	4	
71.	PH2	What do you normally use to wash your hands?	Water only ……	1	
			Both water & soap ……..	2	
			Both water & mud ……	3	
			Both water & ash ……	4	
			Other (specify) ……..	5	
72.	PH3	In your opinion, what disease might occur if hands are not washed properly?	Diarrhoea …….	1	
			Cholera ……	2	
			Dysentery……	3	
			Jaundice ……	4	
			Typhoid ……..	5	
			Stomach ache…….	6	
			Cough & cold ……..	7	
			Others (specify) ……	8	
			Do not know ……	9	
73.	PH4	Do other family members wash their hands using soap and water before eating and after using toilet at school?	All members wash hands …	1	
			Some members wash hands …	2	
			Other (specify) ……..	3	
			Do not know ……..	99	
74.	PH4	Do other family members wash their hands using soap and water before eating and after using toilet at home?	All members wash hands …	1	
			Some members wash hands …	2	
			Other (specify) ……..	3	
			Do not know ……..	4	
	Effect on Health, School regularity, and Educational Achievement				
	Effect on Health (EH)				
75.	EH1	In the past six months have you suffered from any illness?	Yes ……..	1	
			No ……	2	

76.	EH1a	If yes, from which disease were you suffered?	Diarrhoea…… Cholera ……. Dysentery…… Skin disease ……. Eye infection …….. Jaundice …… Respiratory disease …… Seasonal infections …… Water born disease …….. Do not know……..	1 2 3 4 5 6 7 8 9 10	
77.	EH3	If yes, had you visited health facilities for the treatment during the illness?	Yes …… No ……..	1 2	
78.	EH3a	If no, from where did you obtain health services to recover from the mentioned disease?	Home …… Traditional healer …… Other (specify) ……..	1 2 3	
	School Regularity (SR)				
79.	SR1	Have you been absent in your school before past six months?	Yes …… No……. Do not know ……	1 2 3	
80.	SR2	If yes, how many school days did you miss?	Number of missing days in total (……..)		
81.	SR3	If yes, what are the reasons for not attending school?	Illness ……. Inadequate drinking water…. Inadequate toilet ……. Inadequate handwashing stations……..…. Religious work at home/society ... Do not like teacher ……. Fear of punishment ……. Other (specify) ……	1 2 3 4 5 6 7 8	
82.	SR4	If yes, what sorts of absent did you have?	Not present at school …. Left school at mid time …… Rejected by school ……	1 2 3	
83.	SR5	Does your school notice about your absent?	No …… Only once ……. Sometimes …… Usually …….. Always ……	1 2 3 4 5	
84.		Does your family notice about your school absent?	No…… Only once ……. Sometimes……	1 2 3	

			Usually …….	4	
			Always ……	5	
85.	SR6	How many school days have you usually missed during menstruation? (Only for girls)	Number of missing days in total (…….)		
	Educational Achievement (EA)				
86.	EA1	Do you think that the missed classes hampered your exam results?	Yes ……	1	
			No …….	2	
			Do not know ……..	3	
87.	EA2	Do you think that missed classes during your menstruation period hampered your exam results? (Only for girls)	Yes ……	1	
			No ……	2	
			Do not know …….	3	
88.	EA3	What percentage/GPA had you scored in your class?	Percentage/GPA …….		
89.	EA4	What activities have been done in your school to make students more regular?	Activities:		
90.	EA6	Do you fell; you get higher score if you are regular at your school?	Yes …….	1	
			No ……	2	
91.	EA6	Do you fell; you get higher score if you are regular at your school during period? (Only for girls)	Yes …….	1	
			No ……	2	

Appendix C. Key Informants Interview Guidline

S.N.	Key Questionnaires	Probing Questionnaire
1.	Does drinking water is sufficient for all school/family members?	• Availability • Accessibility • Quality
2.	How are your toilet facilities?	• Availability • Accessibility • Quality
3.	How are your handwashing facilities?	• Availability • Accessibility • Quality
4.	Does school WASH condition impacts students' health status and how?	• Students' health condition • Frequency of diseases • Ways of treatment
5.	Does school WASH condition impacts students' school regularity and how?	• Causes of not attending schools (male and female students) • Ways of overcoming from not attending schools
6.	Does school WASH condition impacts students' educational achievements and how?	• Causes that impacts students' educational achievements • Ways of handling the hindering causes

Appendix D. Observation Checklist

Name of the School:

A. School WASH Facility Observation				
1. Water Facilities Observation (WFOB):				
WFOB. 1	Specified drinking water station for students	Yes …… No……..	1 2	
WFOB. 2	Number of drinking water points	Number of drinking water points: …….		
WFOB. 3	If WFOB1 is yes, availability of drinking water in the station during observation	Yes …… No ……..	1 2	
WFOB. 4	If WFOB1 is yes, accessibility of drinking water station to small children (reachable height)?	Yes …… No ……..	1 2	
WFOB. 5	If WFOB1 is yes, accessibility of drinking water station to PWD-limited mobility? (PWD-People with Disability) (Could go, reach, and drink water on their own	Yes …… No ……..	1 2	
WFOB. 6	Stored water for drinking propose	Yes ……. No ……..	1 2	
WFOB. 7	If WFOB6 is yes, storing technique of water for drinking purpose	Overhead tank …… Underground storage tank …… Bucket/Jerricans …… Gagri/Jar/Bottle …… Other (Specify) ……	1 2 3 4 5	
2. Sanitation Facilities Observation (SFOB):				
SFOB. 1	Is there toilet in school?	Yes …… No ……..	1 2	
SFOB. 2	If SFOB1 is yes, structure of the toilet?	Permanent (Concrete up to plinth level and super structure also permanent) ….. Semi- Permanent (Concrete up to plinth but super structure not permanent) ……	1 2	

		No concrete-plinth ……	3	
SFOB. 3	If SFOB1 is yes, provide privacy? (proper door, walls and roots, could be locked from inside)	Boys' toilet provides privacy …… Girls toilet provides privacy …… Both provide privacy …… None provides privacy ……	1 2 3 4	
SFOB. 4	If SFOB1 is yes, toilet cleanliness maintained? (free from faeces and stain pan, no unpleasant smell)	All properly maintained …… Some properly maintained …… None properly maintained ……..	1 2 3	
SFOB. 5	Availability of water inside toilet at the time of observation?	Available in all toilets …… Available in some toilet …… Not available at all ……	1 2 3	
SFOB. 6	Availability of toilet cleaning material inside or nearby toilet?	Brush …… Harpic/detergent/phenol …… Sandal ……. Other (Specify) …… None ……..	1 2 3 4 5	
SFOB. 7	Child friendly toilet? (anyone) (reachable bolt and water point, small stairs)	Yes ……. No ……..	1 2	
SFOB. 8	Features of the toilet for people with disability (PWD)?	Ramp (Slop way) …… Hand trail …… Wide door …… Accessible bolt …… Tactile …… None …… Other (Please specify) ……	1 2 3 4 5 6 7	
SFOB. 9	Available materials/facilities at girls' toilet/ changing room (Multiple answer)	Separate toilet for boys and girls/changing room for girl…… Private for individual use with doors ……. Hand washing facility …… Water ……. Soap …… Covered dustbin/connected to incinerator … Bolt/lock that is working …… Hook or nail ……. None ……	1 2 3 4 5 6 7 8 9	
3. Hygiene Facilities Observation (HFOB):				
HFOB. 1	Hand washing station for students	Yes, nearby toilet …… Yes far from toilet …… No ……	1 2 3	

HFOB. 2	Number of hand washing stations in the school?	Number of handwashing station (……)		
HFOB. 3	Availability of soap & water in hand washing station?	Yes, both …… Only water …… Only soap …… Both are not available ……	1 2 3 4	
HFOB. 4	Proper drainage/outlet for waste water	Yes …….. No ……	1 2	
HFOB. 5	Solid wastes dispersed within the school premises	Yes …….. No ……	1 2	
HFOB. 6	Solid wastes segregated?	Yes …….. No ……	1 2	
HFOB. 7	Incinerator in the school	Yes …….. No ……		
HFOB. 8	Is junk food plastics and packets are easily visible in the school?	A lot of …… Some …… No …….	1 2 3	