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## **Water Wastage in Secondary Schools: A Case of Secondary Schools in Esikhaleni Circuit, King Cetshwayo District, KwaZulu-Natal**

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**Abstract.** South Africa is facing significant challenges of water sustainability due to water scarcity, poor quality and wastages in most of its water supply systems. Unless the said challenges are urgently addressed, the socio-economic aspect of the country is under a significant threat. The hope to deal with these challenges rests upon education. The purpose of the current study was to investigate whether secondary school learners in King Cetshwayo district do practice water wastage and the extent thereof. It also aimed to establish whether secondary schools teach water sustainability in their curriculum. The study will propose strategies for promoting water sustainability in secondary schools. A mixed-methods approach was embraced in this study. Questionnaires, observations and focus group interviews were employed as data collection tools from 120 purposefully selected participants. The findings revealed that secondary school learners practice water wastage and that schools are not promoting water sustainability. Therefore, the study recommended that schools conduct water quantity audits, conduct awareness campaigns, celebrate environmental days, appoint an onsite plumber and install water tanks to harvest rainwater.

**Keywords.** Education for water sustainability, water wastage, secondary schools, water scarcity, water sustainability.

### **Introduction**

In 2015, the United Nations (UN) pronounced seventeen (17) Sustainable Development Goals (SDGs), one of which is goal 6 which seeks for everyone in the world to have access to safe drinking water and improved sanitation by 2030. The UN demands that all States should ensure availability and sustainable management of water and sanitation for all'. Water and Sanitation are the key aspects of sustainable development critical to human and planet survival, especially during this Coronavirus disease (Covid19) pandemic. Notwithstanding, covid19 pandemic, South Africa is facing a nexus of challenges of water sustainability relating to water scarcity, poor quality and wastages in most of its water supply systems. Unless the said challenges are urgently addressed through education, the socio-economic aspect of the country will be under a significant threat. For this reason, education has been thought of as the most important tool that society can utilise in an attempt to solve all their current and future challenges (UNESCO, 1997). Therefore, schools can be regarded as agents of change that can modify the lives of children and promote sustainable development, that is, sustainable use of water. Moreover, the kind of education secondary schools provide must not only equip them

with skills and knowledge but also modify their attitude and behaviour leading towards water sustainability (Nguyen, Nguyen & Tran, 2020).

Therefore, the current study was triggered by the findings of the previous investigation of water wastage conducted by Mbokazi (2009) in primary schools in the same district. The current study sought to ascertain whether secondary schools also practice water wastage the same way as primary schools do. Mbokazi (2009) in their study found that primary schools' learners waste thousands of litters of water through unsustainable water practices. Schools also lose large quantities of water through leaking pipes, broken toilet cistern, lack of understanding of the implications of water wastage and illegal water connections, as a result, schools paid high water bills. The current study will also determine the impact of water wastage in schools and the community at large.

### **Literature review**

EL-Nwsany, Maarouf & Abd el-Aal (2018) advocate that water shortage has become an issue of growing importance all over the world. South Africa is not excluded from this situation. Mbokazi (2009) posits that "South Africa is a water-scarce country and the scarcity is exacerbated by climate change, rising population, poor water quality and water wastage." The cost of water management is huge, while there is an increasing water demand from the growing population, agricultural, industrial and municipal sectors. Schools also use large amounts of water every day and require water for their daily activities such as washing hands, cooking, flushing toilets, heating and cooling systems, drinking, experiments, watering gardens, trees and lawns. One of the worst water management challenges in schools is water wastage. Booysen & Visser (2019) confirm that water wastage is evident in schools whereas Mbokazi (2009) states that it accounts for thousands of litres of water loss through washing and drinking from taps, leaking pipes, taps and toilets. Thus, the challenge is that teachers and learners have become accustomed to leaking pipes and leaking toilets, as well as flooding sinks due to breakages that go unchecked in most schools in the district. Mbokazi (2009), in their study on water wastage in primary schools, they found that water wastage is high in primary schools and school management teams (SMTs) are doing very little or nothing to curb this wastage. Furthermore, the author estimated that one leaking tap can account for up to "two hundred litres of water a day and a total of more than 2000 litres per month."

These challenges are worsened by illegal connections to the main schools' supplies with poor plumbing maintenance. It is thus undesirable that such large quantities of water loss could be used to supply schools with safe drinking water or could be used to provide monthly free basic water to poor households (Booyesen & Visser, 2019). Hence, Masuku (2020) contends that more than 3500 South African schools are still lacking running water. Water will always be in short supply in South Africa; thus it is paramount to develop and manage current water prudently, not only for human consumption and agricultural production but also for the aquatic ecosystems. Water management is one of the main elements of the overall drive of sustainable development (EL-Nwsany, Maarouf & Abd el-Aal 2018). Furthermore, these authors posit that when the number of communities needing water supply continues to increase, the need to conserve water shall also increase. In 2020 water consumption has doubled perpetuated by the outbreak of the Covid19 pandemic. Washing hands is one of the essential strategies to prevent the spread of the virus. However, washing hands while rubbing with soap increased water wastage drastically. The government has to make sure that water is available in sufficient quantities and quality to all communities. Most people leave taps open while washing hand for 20 seconds as suggested. Coelho, Gouveia, Souza, Milfont & Barros (2016) comment that water

wastage, like many other environmental problems, is caused by “human malpractices, behaviours and attitudes”.

#### *Sustainability in secondary schools*

In order to alleviate water-wastage challenges, schools must promote and adopt a sustainable development approach towards water management through water conservation strategies, which include water re-use, water recycling, rainwater harvesting and minimum water consumption (EL-Nwsany, Maarouf & Abd el-Aal, 2018; Mbokazi, 2009; Oliver & Brummer, 2007). Secondary school learners are grown-ups, soon they will assume their full adult lives and develop a more responsible society (do Nascimento, Martins & Amelda, 2014). Schools must produce individuals who are lifelong learners, self-regulated, self-evaluating, critical thinkers and pro-environmental; these individuals must also be capable of applying sustainability knowledge in their daily lives and in new situations (Arik and Yilmaz, 2020). Future citizens must become confident agents for change for the common good, including economic, social and ecological justice; education for sustainability (EFS) at the secondary school level can enhance students’ knowledge and skills that will hopefully lead to water sustainability (Taylor, Quinn, Jenkins, Miller-Brown, Rizk, Prodromou, Serow, Taylor, 2019).

#### **Methodology**

The study is located within the positivist and constructivist paradigms adopting mixed methods of research (Wisdom & Creswell, 2013). The mixed-method has been referred to as “empirical research that involves the collection and analysis of both qualitative and quantitative data” (Almalki, 2016). Mixed methods were selected because they provide great flexibility and are adaptable to many study designs and provide triangulation (Noble & Heale, 2019).

#### *Data Collection Processes and Analysis*

The quantitative and qualitative data were collected from 120 learners from four identified secondary schools under the Esikhaleni Circuit in the King Cetshwayo District of Education during the period of 01 May to 30 June 2021. The quantitative data was collected using a questionnaire consisting of fifteen closed-ended questions. On the other hand, the qualitative data was gathered using a focus-group interview with two learners from each of the sampled schools and non-participant observation. Questionnaires with closed-ended questions do not enable respondents to add any clarification to the response and pose a risk that the response might not be complete and that there might be bias in them (Oppenheim, 1992). Therefore, triangulation was necessary to complement this shortfall. Focus group interview was instituted to catch the “authenticity, richness, depth of response, honesty and candour which are the hallmarks of qualitative data” (Cohen, Manion & Morrison, 2005). The researcher also visited identified schools to administer questionnaires and conduct focus group interviews on water activities in schools. Non-participant observation (Busetto, Wick, & Gumbinger, 2020) was also employed to capture data on real-life settings (Cohen, Manion & Morrison, 2005), that is how learners interact with water in schools. The researcher recorded all activities observed in the prepared observation schedule. The non-participant observation was conducted to complement the results obtained from the questionnaire and interviews. A focus group interview and observations made in schools triangulated data obtained through questionnaires. Thematic analysis was employed to code the data and identify themes. Participants were assured that their names would be kept confidential, anonymous and non-traceable in the research by coding their names for reporting purposes and that they could choose to withdraw at any time when they felt like doing so (Cohen, Manion & Morrison, 2005; Ning, Cheung & Guo, 2019). Thematic analysis of transcribed answers from focus group interviews and observations

provided insight into the causes and strategies that could be implemented to curb water wastage and promote water sustainability. The quantitative data was captured using the Statistical Package for Social Sciences (SPSS), a software employed to calculate the percentage, mean scores, P-value and statistical significance.

#### *Research Setting and Sampling Procedure*

The study was conducted in secondary schools located in the Esikhaleni Circuit under the King Cetshwayo district of education. Esikhaleni Circuit is comprised of a total of fourteen (14) secondary schools and sixteen (16) primary schools. The researcher chose to study four secondary schools which were conveniently sampled due to their locality and continuous supply of water. Respondents of this study were 30 learners from each of the four identified secondary schools and the total sample size was one hundred and twenty (120) learners.

#### **Results**

Each of the 120 randomly selected learners in secondary schools was asked to complete a questionnaire consisting of 15 questions. The first 7 questions in the questionnaire were asked to determine the extent of each of the seven water wastage practices. The next eight questions were concerned with the extent to which schools promote water sustainability. Each question in the questionnaire was in the form of a statement. As a response, the respondents had to indicate the extent to which they agreed with the statement. The possible responses were on the Likert scale with strongly agree – 1, agree – 2, neither – 3, disagree – 4, strongly disagree – 5.

#### *Water Wastage Practices*

Table 1 below depicts the summary of responses to water sustainability questions. The first 4 quantities shown in the table (mean, % agree, % disagree, % neither) are self-explanatory. In the last column, ratio = % agree, % disagree is a measure that compares the percentages who agree and disagree.

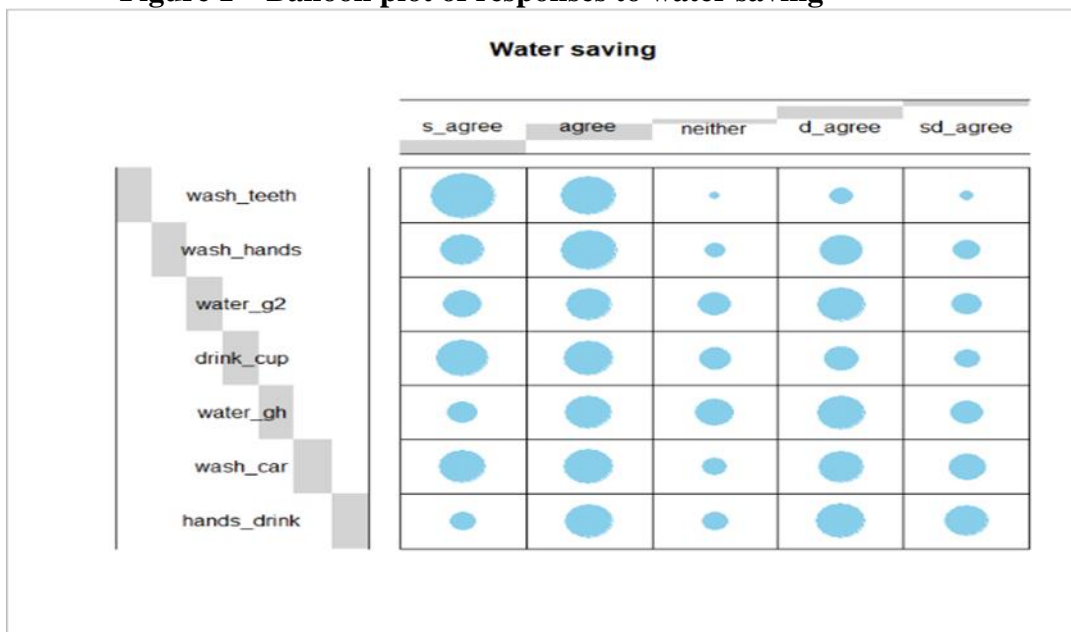
**Table 1 – Summary of responses to water wastage questions**

<b>Practice</b>	<b>Mean</b>	<b>% agree</b>	<b>%disagree</b>	<b>%neither</b>	<b>Ratio</b>
wash_teeth	1.71	89.2	9.2	1.7	9.696
wash_hands	2.53	63.3	31.7	5	1.997
water_g2	2.88	45	40.8	14.2	1.103
drink_cup	2.33	64.2	23.3	12.5	2.755
water_gh	3.04	39.2	41.7	19.2	0.94
wash_car	2.93	49.2	43.3	7.5	1.136
hands_drink	3.35	36.7	55	8.3	0.667

The mean in Table 1 is seen as an average measure of disagreement. The value refers to the extent of disagreement. The larger the mean, the more the disagreement, for instance, learners disagreed more with ‘I drink using my hands from the tap’ and ‘I use a hosepipe to water the garden’. These statements recorded a mean score of 3.35 and 3.04, respectively. Most students (89.2%) agreed that they turn off water taps when brushing their teeth, hence the mean score recorded was 1.71 and 63.3% of the respondents agreed that they turn off taps when washing their hands. Some respondents (64.2%) confirmed that they use containers such as glasses or cups to drink water from the tap and 55% refuted drinking with hands from taps.

However, observation revealed contrasting information, it was observed that learners in most schools, drink from taps with their hands since there were no cups or glasses prepared for them to use. The association test was conducted and a Chi-square= 2.8628 with p-value = 0.09065 was significant at 10%. Some respondents (39.2%) affirmed that they water the garden with a hosepipe, whereas 49.2% wash cars with a hosepipe. When the test for association was applied, a Chi-square = 10.895 with p-value = 0.0009644 was highly significant. Those who disagree with watering the garden with a hosepipe are more likely to disagree with washing the car with a hosepipe (31 versus 19) than those who agree/neither with watering the garden with a hosepipe (21 versus 49). The water garden twice versus using hosepipe in the garden table appear to be slightly different at the different levels of ‘use a hosepipe to wash the car’. At use hose pipe to wash car = disagree the odds ratio for agree/neither to disagree is  $(18/13)/(3/18)=8.31$  and at use hose pipe to wash car = agree/neither it is  $(31/9)/(18/10)=1.91$ . The Breslow-Day test for equality of odds ratios has a test statistic value of 2.7024 with a p-value of 0.10, which is some evidence against the hypothesis of equal odds ratios. The results of the focus group interviews indicated a preference to use a horse pipe when washing the car and watering the garden because it’s quick and thorough. “Using a pipe to wash the car is more easy and quick.” Another learner said “a hose pipe saves time and energy.”

**Figure 1 – Balloon plot of responses to water saving**



The balloon plot figure 1 shows the extent of agreements with various statements. The sizes of the balloons are proportional to the counts observed for the extent of agreement with the statements. The plot suggests that the respondents most strongly agree with “I turn off the water tap when brushing my teeth or rinsing the dishes’ and most strongly disagree with ‘I drink from the tap using my hands’.

*Water Sustainability Practices*

Table 2 below depicts the summary of responses to water sustainability questions. The first 4 quantities shown in the table (mean, % agree, % disagree, % neither) are self-explanatory. In the last column, ratio = % agree/% disagree is a measure that compares the percentages of those who agree and those who disagree.

**Table 2 – Summary of responses to water sustainability questions**

<b>Practice</b>	<b>Mean</b>	<b>% agree</b>	<b>% disagree</b>	<b>% neither</b>	<b>Ratio</b>
drip_taps	3.7	21.7	67.5	10.8	0.321
rainwater_tank	3	40.8	50.8	8.3	0.803
waterwaste_affect	1.8	83.3	9.2	7.5	9.054
teach_watersaving	2.63	55	30.8	14.2	1.786
celebrate_water	4.31	5	87.5	7.5	0.057
drip_toilet	3.43	31.7	55	13.3	0.576
leakrepair_immediate	2.53	56.7	25.8	17.5	2.198
washplate_tap	2.02	82.5	12.5	5	6.6

The mean in Table 2 can be seen as an average measure of disagreement. The value refers to the extent of disagreement. The larger the mean, for example, 4.31; 3.7 and 3.41 above, the more the disagreement. Very few schools (21.7%) have dripping taps and 31.7% have dripping toilets (table 2). The results also revealed that 56.7% of respondents claim that leaking toilets, pipes and taps are immediately repaired. In some schools, it was observed that there were leaking taps and they have been leaking for quite some time and were not attended to.

A test was also performed to examine the association between dripping taps/toilets and repairing leaking taps/toilets immediately. The test recorded a chi-square = 18.403 with p-value = 1.788e-05 which is highly significant. Respondents who disagree that there are leaking taps are more likely to disagree that the leaks are repaired immediately (56 versus 25) than those who agree/neither with it (10 versus 29).

Half of the respondents (50.8%) stated that their schools do not have water tanks to collect rainwater. Some learners responded as follows when asked about collecting rain water.

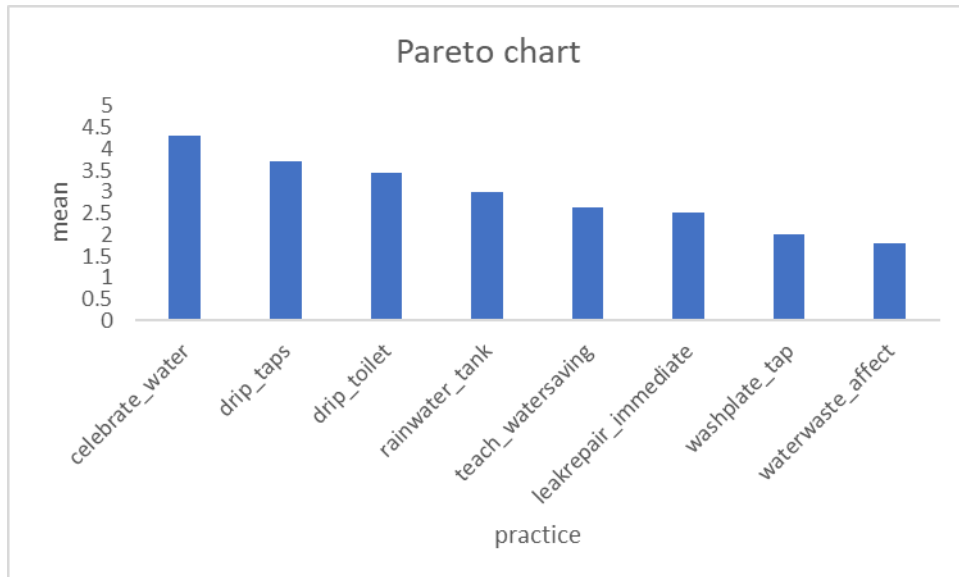
‘We do have water tanks but I had never used water from them.’ Another learner sighed and responded: ‘I don’t know whether there is water or not in the tanks.’ Others responded as follow:

‘There are no water in tanks, learners remove taps’

The results also revealed that 55% of respondents confirm that schools teach water-saving techniques and recorded a lower mean score of 2.63. Focus group interviews and observations confirm that schools do not collect rainwater and it was observed that very few schools have water tanks, even those who have water tanks do not use them efficiently. Some had broken taps or taps were completely removed from tanks.

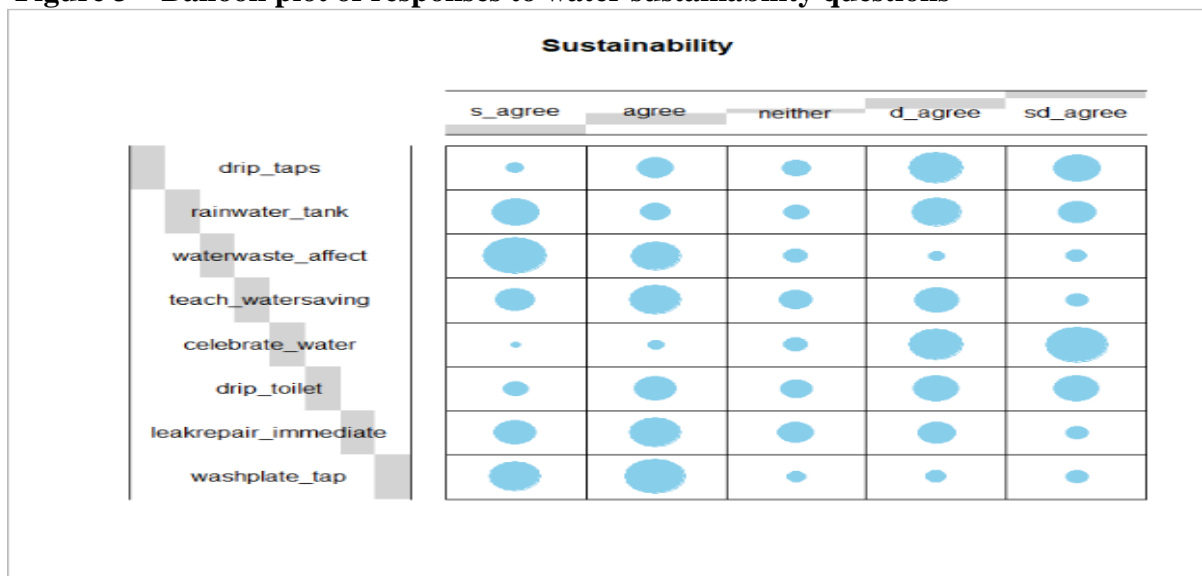
The findings also revealed that schools do not celebrate environmental days such as water week, national arbor day and world wetlands day; 87,5% of respondents affirmed this statement. The highest mean score of 4.31 indicates the highest disagreement of respondents. A test was performed to test the association between teaching water-saving and celebrating water week every year. Test results indicate a Chi-square = 3.4889 with p-value = 0.06178 which is significant at the 10% level. There is some evidence that those who disagree that water-saving techniques are taught are more likely to disagree that water week is celebrated yearly (36 versus 1) than those who agree/neither (69 versus 14). Learners were also asked how they celebrate environmental days in their schools., In fact, all learners denied having heard about environmental days' celebrations in their schools. However, one learner remembered planting of trees in their school but had forgotten the details since it happened long time ago.

**Figure 2 – Pareto chart of mean responses to water sustainability questions**



From the Pareto Chart, figure 2 above, it can be seen that the respondents disagree most with ‘My school celebrates water week every year’ and agree most with ‘Water wastage affects the school, the community and the municipality’. Focus group interviews affirmed that water wastage is a problem and it affects everyone.

**Figure 3 – Balloon plot of responses to water sustainability questions**



The balloon plot, figure 3, indicates that the respondents most strongly agree with ‘Water wastage affects the school, the community and the municipality’ followed closely by ‘Each learner washes his/her plate from the tap’ and most strongly disagree with ‘My school celebrates water week every year’.

### **Discussion**

The purpose of this study was to determine whether secondary school learners' practise water wastage and the extent thereof. It also investigated whether secondary schools promote education for water sustainability in their teachings. Water education for sustainability is an important field of practice in education because of its need, scarcity and the mandate of the United Nations, Sustainable Development Goals (SDG) that forge all countries by 2030 to have supplied all their citizens with clean drinking water. Sustainably managing our use of water should positively contribute to the goals of sustainable development. The communities too must be able to use this precious resource prudently to allow the continuous flow of water in their taps. As a result, schools have a huge responsibility to teach their learners water sustainable practices as they are able to inculcate these to their families; learners are future citizens who will be expected to instill sustainable behaviours or practices in their children.

Secondary school learners were found to be involved in water wastage practices. Out of 8 statements on water sustainable practices, learners did well only in one statement, whereby 89% opined that they switch off the taps when brushing their teeth. The rest of the statements had divided opinions. This suggests that secondary school learners are involved in unsustainable environmental practices which result in water wastage. Berryman & Breighner (1994) and Higgs & McMillan (2006) contend that this is due to inconsistency between teaching and practice which then confuse learners. Schools have a great contribution to make towards the promotion of the water unsustainability behaviour of learners. The results revealed that they neither teach water sustainability concepts nor celebrate water week or environmental days as part of environmental awareness. Environmental concepts, such as environmental sustainability, water sustainability, are not taught, or they are taught just as part of syllabi for examination purposes, not as a lifestyle to be adopted. Therefore, their educational effort has no impact on the lives of their learners. Lam, Hsieh & Zhan (2013) argue that Environmental Education focuses on providing scientific education in raising environmental awareness. If it was taught to these learners, they would acquire a positive attitude towards water.

The schools model unsustainable water practices to their learners (Higgs & McMillan, 2006). This means that they lack pro-sustainable behaviours. The evidence is demonstrated by the leaking taps and toilets that are not immediately repaired and most of them have no tanks to harvest rainwater. Thousands of litres of water are gushed down the drain as wastewater. Secondary schools further allow learners to individually wash their plates on running taps which waste massive quantities of water. Education for sustainable development incorporates economic, social and environmental factors to bring about solutions to achieve sustainability (Lam, Hsieh & Zhan, 2013). The use of harvested rainwater may save the schools some money which could be used to purchase learning and teaching support material, improve the general welfare of the school, and reduce water sustainability stress. Therefore, secondary schools should incorporate education for sustainable development in their curriculum. ESD is viewed as a balanced education approach (McKeown & Hopkins, (2007); Sarabhai, (2014) to promote education for water sustainability.

### **Conclusions**

Based on the data drawn from the study, the following conclusions were drawn:

Water wastage negatively impact the school, community, agriculture and industry as the massive users of water. Secondary schools are involved in water wastage practices; therefore, they are not promoting and inculcating water sustainability in their learners.

### Recommendations

For the schools to mitigate water wastage practices, they need to adopt the following sustainable strategies:

- Schools have a responsibility to conduct environmental awareness by celebrating environmental days such as water week, arbor day, wetland day, world recycling day, earth day and many more.
- During these environmental special days, learners are taught the importance of these environmental issues, and to solve problems associated with these issues. Environmental awareness is more effective in changing attitudes towards environmental conservations.
- Broken taps and toilets must be repaired with immediate effect to reduce water wastage and to save school revenue. Thousands of litres are wasted through leaking taps and toilet cisterns per annum.
- For the school to be able to respond promptly to water leakages, they need to appoint an onsite plumber who will repair and replace damaged pipes from time to time.
- Secondary schools must install water tanks to collect rainwater which could be used in kitchens, flushing toilets, washing hands, cleaning and watering gardens.
- Schools need to adopt water sustainable strategies such as water re-use, water recycling and water usage reduction.
- Schools are to conduct water quantity audits to establish the quantities of water loss.
- Further research is necessary to investigate the actual amount of water wastage and the actual amount of money lost as a result of such wastage.

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