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Integrated Sanitation and Hygiene Program to Curb the Case of Helminthiasis: An Experimental Study Among School-Age Children in a Coastal Town in the Philippines

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ABSTRACT

Approximately 24% of the world's populations, mostly school-age children, are infected with soil-transmitted helminthes; with the majority in tropical and subtropical areas. The Philippine islands are endemic to soil-transmitted helminth with approximately 25 million Filipinos at risk of acquiring the infection. Despite the deworming program of the Department of Health (DOH), re-infection is very common. This study investigated the effect of integrated sanitation and hygiene program among the second grade students of a coastal town in the Philippines. Utilizing quasi-experimental study, two group pretest and posttest design, 70 participants from the elementary school of a coastal town in the Philippines were chosen randomly to join the study. Overall result showed that experimental group maintained a zero re-infection during the first and second months after the intervention; while the control had one case of re-infection. Moreover, result showed significant difference during pretest and posttest on knowledge ($p = <0.05$) and self-efficacy ($p = <0.05$) but not significant on practice ($p = 0.77$). Analyzing the two groups, significant difference was noted between the experimental and control group on knowledge ($p = <0.05$) and self-efficacy ($p = <0.05$), with the experimental group faring better after one and two months post intervention; but no significant difference was noted on practice, one and two months post intervention ($p = 0.56$, 0.43). The odds of the experimental group acquiring helminthiasis was 68% lower than the control group but is not considered significant ($OR = 0.32$; $p = 0.49$). The program was successful in reducing the re-infection of helminthiasis and is recommended that continuous health education on hygiene and sanitation must be considered in the home and school.

Keywords: Hygiene, Sanitation Program, Helminthiasis, Self-Efficacy, Knowledge

INTRODUCTION

Nearly billions of people are known to have fallen ill to at least one helminth species in their life time (Mascarini-Serra, 2011). The World Health Organization (2016) identified that the common group of helminths found to infect individuals worldwide are the soil-transmitted helminth (STH). The soil-transmitted helminths are commonly composed of the roundworm, scientifically known as Ascaris lumbricoides, whipworm which is known as Trichuris trichiura, and hookworm with two common species namely Necator americanus and Ancylostoma duodenale. Helminthiasis are predominantly seen in poor and developing countries (CDC, 2017). Approximately 24% of the world's population was infected with soil-transmitted helminths and the majority is distributed in tropical and subtropical areas with the highest numbers found in sub-Saharan Africa, the Americas, China and East Asia (World Health Organization, 2016). Moreover, researches and surveys mentions that helminthiasis predominantly plagues the school- aged children (Alemu, Tegegne, Damte & Melku, 2016; Odinaka et al., 2015). The Philippine islands are endemic to soil-transmitted helminth with approximately 25 million Filipinos are at risk of acquiring the helminthiasis. A study showed that 34.1% of the school children had at least one STH infecting them and out of that, 5.9% had heavy intensity infections (Belizario, Totañes, De Leon, Lumampao, & Ciro, 2011). Among the risk factors that make children susceptible to STH high are: children who did not practice good hygiene such as walking barefoot, and not washing of hands before eating, low socio-economic status of parents and open defecation (Alemu, Tegegne, Damte, and Melku, 2015).

Thus, this study aims to determine the effects of a health education program entitled "Integrated Sanitation and Hygiene" (iWASH), coupled with mass deworming, on the knowledge, practice, self-efficacy and cumulative prevalence of helminthiasis among the school-aged children. Further, it will seek to answer the following:

1. To determine the experimental and control group pre-intervention (baseline) characteristics in terms of: knowledge in personal hygiene and sanitation, practices in personal hygiene and sanitation, and self-efficacy in personal hygiene and sanitation
2. To determine the post-intervention characteristics of experimental and control group in terms of: knowledge in personal hygiene and sanitation, ractices in personal hygiene and sanitation, and self-efficacy in personal hygiene and sanitation
3. To determine the significant difference in mean score between the pre-intervention and post-intervention characteristics of experimental group in terms of: knowledge, practice, and elf-efficacy.
4. To determine the significant difference in mean score between the experimental and control group after the health program in terms of: knowledge, practice, and self-efficacy

5. To determine the odds of the experimental group to acquire helminthiasis against the control group.

LITERATURE REVIEW

Poor hygiene and sanitation are often mentioned as major risk factors to helminthiasis (WHO, 2017). Hygiene refers to the personal practices and environment condition that help stop infection and the spread of it. Several studies suggest that the unhygienic practices such as not washing of hands, not bathing, untrimmed nails, eating food that fell on the ground, walking barefoot and not washing of hands after toilet use are risk factors of helminthiasis (Mascarini-Serra, 2011; Mengistu, Melaku, & Tesfu, 2014; Getnet, 2015; Mirisho, Neizer, & Sarfo, 2017; Schmidlin, Hurlimann, Silue et al., 2013; Suriptiastuti & Manan, 2016). Several studies have shown that health education about the cause and mode of infection of helminths, hygiene and sanitation practices and other health-related topics, are some of the strategies to combat this type of infection (Alelign, Degarege, & Erko, 2015; Alemu, Tegegne, Damte, & Melku, 2016; Getnet, 2015; Mengistu, Melaku, & Tesfu, 2014). For example, a study discovered that the lack in knowledge among indigenous people of Malaysia in terms of the mode of transmission and causes of helminthiasis is negatively associated to the number of infection (Nasr, Al-Mekhlafi, Ahmed, Roslan, & Bulgiba, 2013). In India, the lack of knowledge and awareness of mode of transmission lead to bad practices in terms of hygiene, which is significantly associated with the incidence of helminthiasis (Tripura, Reang, Tripura, & Roy, 2013). However, a health-education package tailored to the situation was able to increase the students' knowledge about soil-transmitted helminths and later lead to a change in practice (Phongluxa, Xayaseng, Vonghachack et al., 2013). In changing the hygienic practices, several factors need to be considered. For example, a study showed that water temperature and volume of soap has no significant effect in reducing the organism (Jensen, Macinga, Shumaker et al., 2017); but the lather time has a significant effect in reducing the presence of organisms. This is important because in an assessment of public toilet users in 2013 only 5% of the people wash their hands for the right duration (Borchgrevink, Min cha, & Yun Kim, 2013). The source of water whether to be used for hand washing or drinking is also a factor to be considered; researchers found that wash bowls used in schools and at home contained eight species of bacteria, two parasites and some fungus species (Tetteh-Quarcoo, Anim-Baidoo, Attah et al., 2016). Sanitation refers to the provisions, facilities, and services that are offered for safe disposal of wastes (World Health Organization, 2015). Such factors can either yield positive or negative effect in the community's health. Studies have shown that the lack of proper sanitation and sewage disposal systems pose risk of helminth infection (Echazú, Bonanno, Juarez et al., 2015; Odinaka, Nwolisa, Mbanefo, Iheakaram, & Okolo, 2015). Limited access and poor quality of environmental and water sanitation, presence or absence of latrine, and type of toilets are all contributing factors to the prevalence of helminthiasis (Worrell, Wiegand, Davis et al., 2016). Practicing good hygiene and sanitation is a choice that an individual needs to make, a choice that is influenced by multiple factors. Knowledge helps in the process but it is not enough. The progression of knowledge to practice is often hindered by cultural norms and what the individual believes which in turn impacts their perception and practice (Akter & Ali, 2014). One's belief in their ability to be better and go against what is already known despite the odd is called self-efficacy; improvement of self-efficacy levels can push an individual to take corrective measure concerning health. Researches have shown that individuals who displayed higher self-efficacy are most likely to change their behavior (Sheeran, Maki, Montanaro et al., 2016). The integrated hygiene and sanitation program (iWASH) is a health education program meant to be integrated with another complementary program such as deworming to achieve long term effectiveness. The mentioned program is based on the World Health Organization's (WHO) water, sanitation and hygiene program or W.A.S.H; modified to focus primarily on hygiene and sanitation. The integration of education and treatment becomes paramount to the control and prevention of helminthiasis and other infectious diseases. The W.A.S.H program was chosen to be the blueprint of iWASH because the implementation of the W.A.S.H program was able to reduce and control infectious diseases such as cholera infections (Taylor, Kahawita, Cairncross, & Ensink, 2015); seen to lower the odds of schistosoma infection (Grimes, Croll, Harrison et al., 2015) and was able to reduce the risk of diarrhea among 0-5 years old children (Darvesh, Das, Vaivada et al.,2017). However, no matter how successful a program is, it is important to note that in a community-based program, success is usually dependent not only on the design of the intervention but also on the community's cooperation (Howard-Grabman, Miltenburg, Marston, & Portela, 2017).

METHODS

This research utilized a quasi-experimental two group pretest-posttest design. Two groups were selected randomly; one served as the experimental group and the other, as a control group. The dependent variables were measured in both groups at the same time and the intervention was introduced to the experimental group while the control group was left as is. For this study, grade 2 pupils were randomly selected to be the participants utilizing random cluster sampling. Table 1 shows that there are 25 and 24 males in experimental and control group respectively and 10 and 11 females in experimental and control group correspondingly. Both groups consisted of 35 participants from the second grade and from two different public schools, which gives to a total of 70 respondents who took part in the study.

Table 1. **Distribution of Respondents According to Research Group and Gender**

	Males	Females	Total
Experimental group	25	10	35
Control group	24	11	35
Total			70

The collection of data was composed of a pre-test before the program and a post after the program. The pre-test is composed of the following: (a) questionnaire, (b) observed assessment, and (c) stool analysis. Prior to the collection of data from the participant, consent was taken. The participants answered the questionnaire with their parents/guardian. The instrument used was validated by Experts and underwent backward and forward translation. A pilot testing was conducted with reliability scores of .770, .606 and .616 for knowledge, practice and self-efficacy respectively. The study went through the Ethics Review Board of the University.

RESULTS

To determine the experimental and control group's pre-intervention (baseline) characteristics regarding personal hygiene and sanitation in terms of knowledge, practices and self-efficacy, a descriptive analysis was used, as revealed in table 2.

Table 2. **Summary of the experimental and control group's pre-intervention (baseline) characteristics in terms of knowledge, practice and self-efficacy**

		Knowledge			Practice			Self-Efficacy		
	N	**Mean**	**SD**	**Scale**	**Mean**	**SD**	**Scale**	**Mean**	**SD**	**Scale**
Experimental	35	9.23	2.09	*High	2.28	0.23	**Sometimes	2.18	0.46	***Moderate
Control	35	9.77	1.99	*High	2.27	0.24	**Sometimes	2.23	0.40	***Moderate

** Knowledge: 13-11 (very high, Excellent level of knowledge), 10-8 (high, Good level of knowledge), 7-5 (Moderate, Satisfactory level of knowledge), <4 (low, poor level of knowledge)*
***Practice: 3.0-2.34 (Always), 2.33-1.67 (Sometimes), 1.66-1.0 (Never)*
****Self Efficacy: 3.0-2.34 (capable: High efficacy), 2.33 -1.67 (Somewhat Capable: Moderate efficacy) 1.66-1.0 (Incapable: low efficacy)*

Preliminary results showed that both experimental and control groups have *good level of knowledge*, both groups *sometimes* practice proper hygiene and sanitation and have *moderate* self-efficacy. Result showed that both the control and experimental groups have comparable characteristics.

One day after the program intervention, also known as *Day 0*, the same test was conducted; table 3 reflects the result using descriptive statistics.

Table 3. **Summary of the experimental and control group's post-intervention characteristics in terms of knowledge, practice and self -efficacy, Day 0**

		Knowledge			**Practice**			**Self-Efficay**		
	N	**Mean**	**SD**	**Scale**	**Mean**	**SD**	**Scale**	**Mean**	**SD**	**Scale**
Experimental	35	12.03	1.27	*Very High	2.32	0.24	**Sometimes	2.51	0.29	***High
Control	35	9.77	2.0	*High	2.29	0.25	**Sometimes	2.25	0.40	***Moderate

** Knowledge: 13-11 (very high, Excellent level of knowledge), 10-8 (high, Good level of knowledge), 7-5 (Moderate, Satisfactory level of knowledge), <4 (low, poor level of knowledge)*
***Practice: 3.0-2.34 (Always), 2.33-1.67 (Sometimes), 1.66-1.0 (Never)*
****Self Efficacy: 3.0-2.34 (capable: High efficacy), 2.33 -1.67 (Somewhat Capable: Moderate efficacy) 1.66-1.0 (Incapable: low efficacy)*

Result showed that there was no change in the mean score of the control group in terms of knowledge (9.77), practice (2.29), and self-efficacy, (2.25) with verbal interpretation *of high* knowledge, *sometimes* on practice, and *moderate* self-efficacy, respectively. However, there was an increase in the mean score among the experimental group in terms of knowledge, (12.03), practice (2.32) and self-efficacy (2.51) with verbal interpretation of *very high* knowledge, *sometimes* on practice and *high* self-efficacy.

Thirty days after the program intervention, also known as *Day 30*, a similar test was conducted. Table 4 reflects the result.

Table 4. **Summary of the experimental and control group's post-intervention characteristics in terms of knowledge, practice and self -efficacy, Day 30**

		Knowledge			**Practice**			**Self-Efficacy**		
	N	**Mean**	**SD**	**Scale**	**Mean**	**SD**	**Scale**	**Mean**	**SD**	**Scale**
Experimental	35	11.91	1.22	*Very High	2.31	0.24	**Sometimes	2.52	0.29	***High
Control	35	9.80	2.10	*High	2.26	0.25	**Sometimes	2.26	0.40	***Moderate

** Knowledge: 13-11 (very high, Excellent level of knowledge), 10-8 (high, Good level of knowledge), 7-5 (Moderate, Satisfactory level of knowledge), <4 (low, poor level of knowledge)*
***Practice: 3.0-2.34 (Always), 2.33-1.67 (Sometimes), 1.66-1.0 (Never)*
****Self Efficacy: 3.0-2.34 (capable: High efficacy), 2.33 -1.67 (Somewhat Capable: Moderate efficacy) 1.66-1.0 (Incapable: low efficacy)*

Result showed that there was not much change in the mean score of the control group in terms of knowledge (9.80), practice (2.26), and self-efficacy, (2.26) with verbal interpretation *of high* knowledge, *sometimes* on practice, and *moderate* self-efficacy, respectively. As for the experimental group, there was also not much change in the mean score in terms of knowledge, (11.91), practice (2.31) and self-efficacy (2.52) with verbal interpretation of *very high* knowledge, *sometimes* on practice and *high* self-efficacy.

To determine the significant difference in mean score between the pre-intervention and post-intervention characteristics of experimental group during the pre-test, post interventions day 0 and day 30, respectively, in terms of knowledge, practice and self-efficacy on personal hygiene and sanitation, this research utilized ANOVA for analysis, as revealed in Table 5.

Table 5. **ANOVA Test Results of the Experimental Group**

Variable	**Pre-test**			**Post-Test (day 0)**			**Post-test (day 30)**			**ANOVA**			**VI**
	N	Mean	SD	N	Mean	SD	N	Mean	SD	df	F	P	S
Knowledge	35	9.23	2.09	35	12.03	1.27	35	11.91	1.22	2	85.309	<0.001	S
Practice	35	2.28	0.23	35	2.32	0.24	35	2.31	0.25	2	10.088	.770	NS
S.E	35	2.18	0.46	35	2.51	0.28	35	2.52	0.30	2	0.262	<0.001	S

S.E= Self-Efficacy, VI=Verbal Interpretation, S=Significant, NS=Not Significant

Results showed that there were significant differences in knowledge (p=<.001, SD=1.22) and self-efficacy (p=<.001, SD=0.30) but no significant difference in practice (P=.77, SD=0.25).

To determine the significant difference in mean score between the experimental and control group after the health program in terms of knowledge, practice and self-efficacy, the study utilized independent t-test to compare the data sets as revealed in succeeding tables 6a, 6b and 6c.

Table 6b. **Difference in Knowledge Between the Experimental and Control Group.**

	Group	N	Mean	SD	T	df	p-value	VI
Pre knowledge	Experimental	35	9.23	2.09	-1.114	68	0.269	NS
	Control	35	9.77	1.99				
Post knowledge	Experimental	35	12.03	1.27	5.63	57.60	<0.001	S
	Control	35	9.77	2.00				
Post knowledge(30 days later)	Experimental	35	11.91	1.22	5.15	5.69	<0.001	S
	Control	35	9.80	2.10				

Table 6b. **Difference in Practice Between the Experimental and Control Group**

	Group	N	Mean	SD	t	df	p-value	VI
Pre-test	Experimental	35	2.28	0.23	0.252	68	0.802	NS
	Control	35	2.27	0.24				
Post-test	Experimental	35	2.32	0.41	0.580	68	0.564	NS
	Control	35	2.28	0.25				
Post-test (after 30 days)	Experimental	35	2.31	0.25	0.790	68	0.432	NS
	Control	35	2.26	0.26				

Table 6c. **Difference in Self-Efficacy Between the Experimental and Control Group**

	Group	N	Mean	SD	t	df	p-value	VI
Pre-test	Experimental	35	2.18	0.46	-.463	68	0.645	NS
	Control	35	2.23	0.40				
Post-test	Experimental	35	2.51	0.28	3.11	68	0.003	S
	Control	35	2.25	0.40				
Post- test (30 days after)	Experimental	35	2.52	0.30	3.08	68	0.003	S
	Control	35	2.26	0.40				

The pre-test on knowledge, practice and self-efficacy between the experimental and control was not significant, which further conveys that both groups were comparable. On day 0 and day 30 post interventions, there were noted significant difference between the two groups on knowledge (p=<0.001, day 0 and p=<0.001, day 30) and self-efficacy (p=0.003, day 0 and p=0.003, day 30). However, there was no significant difference in practice (p=0.564, day 0 and p=0.432, day 30).

To determine the odds of the experimental group to acquire helminthiasis against the control group, first, the researcher conducted stool exam during pre-test and post-test for both groups to find out the cumulative prevalence of helminthiasis. For experimental group, there was a prevalence of 14% and for control group was 11%. Post intervention showed that the experimental group had 0% prevalence while the control group had 3% prevalence. Second, the odds ratio (OR) was computed to determine if the exposure to the program will lead to a better outcome. Table 7 shows the result.

Table 7. **Odds Ratio Between Integrated Sanitation and Hygiene program and helminthiasis.**

	Helminthiasis		**Total**
Integrated sanitation and hygiene program	Presence	Absence	
Presence (experimental group)	0	35	35
Absence (control group)	1	34	35
Total	1	69	70
Odds ratio	0.32		
95%CL	0.013 to 8.23		
P=value	0.495 (NS)		

The odds ratio of 0.32 denotes that individuals in experimental group, who went through the program, has lower odds to acquire helminthiasis than individuals in the control group; specifically, the odds of infection in the experimental group is 68% lower than the control group. In other words, exposure to the health program lessen or protects individuals from acquiring helminthiasis.

DISCUSSION

This study sought to discover the effect of an integrated sanitation and hygiene program on the knowledge, practice, self-efficacy and the cumulative prevalence of helminthiasis among grade 2 pupils living in a coastal town in the Philippines. The health education program was done together with the ongoing deworming program in the community, which despite its regular activity, re-infection is still very common. Hence, a program tailored for the children and incorporated in their class which lasted for one month and over 12 sessions, was created.

Results showed that both groups (experimental and control) were comparative as during pre-test, there was no significant difference in knowledge (high), practice (sometimes) and self-efficacy (high) prior to the intervention. Two post-intervention tests were conducted, known as Day 0, or one day after completing the intervention program, and Day 30, or 30 days post program intervention. Result showed that the experimental group had very high knowledge and high self-efficacy while the control group had no change, both during Day 0 and Day 30, respectively. However, the practice remained the same both for control experimental and control groups. Further analysis showed that there were significant differences in knowledge and self-efficacy between control and experimental groups but showed no significant difference in the practice, both in Day 0 and Day 30, respectively.

Upon examining the cumulative prevalence of helminthiasis, the experimental group remained at zero percent prevalence post intervention while the control group increased. Further analysis showed that the experimental group has an overall lower risk of acquiring helminthiasis as compared to control group.

The fact that the respondents have already an existing high knowledge prior to the intervention shows that they must have gained it from the parents' teaching and guidance (Huat See, and Gorard, 2015). Further, a study revealed that primary pupils have good knowledge of hygiene and sanitation (Besha et al., 2016). However, such knowledge is not always translated into practice. For example, in some studies, participants who displayed good to high level of knowledge in regards to hygiene and sanitation failed to translate that set of knowledge into practice (Pang, Chua, & Hsu, 2015; Qadir, Akhtar, Khan et al., 2017; Schlegelmilch, Lakhani, Saunders, & Jhangri, 2016). Furthermore, a study showed that in spite of the parents and the children having the knowledge about hygiene, sanitation and helminthiasis, there is no action toward preventions (Masaku, Mwende, Odhiambo et al., 2017). A strong self-efficacy is an important part in decision making and may lead to high intentionality of practicing positive health behavior; however, self-regulatory skills which is a combination of self-efficacy and planned action, are needed by the parents to help their children maintain such positive behavior (Hamilton et al., 2018).

Result of this study showed that there was a significant difference in the knowledge and self-efficacy of the participants during Day 0 and Day 30, respectively. However, there was no significant difference in their practice in both posttests. The minor effect of the integrated sanitation and hygiene (iWASH) program on the participant's practice despite its major effect on knowledge and self-efficacy can be argued that the program was not long enough to better facilitate behavior change. According to a study, it takes an average of 66 days for a practice or behavior to manifest (Lally, Van Jaarsveld, Potts, & Wardle, 2009). Moreover, another study suggested that cultural beliefs and practices inherent to them were some of the factors that caused hindrance of the translation of knowledge to action (Masaku et al., 2017). Overall, the risks of the experimental group in acquiring helminthiasis were 68% lower than the control group. This further shows that exposure to the health program, together with the deworming activity lessen or protects individuals from acquiring helminthiasis. This result is in line with another study that was also able to lower the odds of helminthiasis specifically the soil-transmitted helminth after the implementation of a program (Strunz, Addiss, Stocks et al., 2014) and another study that concluded that it was also successful to lower the odds of schistosoma infection (Grimes, Croll, Harrison et al., 2015).

A regular deworming program for the elementary school aged children is not enough to prevent reinfection of helminthiasis. Result of this study has shown that a tailored health education program on hygiene and sanitation, together with the current deworming program, done over a longer period of time, were effective in reducing the re-infection of helminthiasis among the children. However, for sustainability, this requires a collaborative effort between the school, the community and the family. The program implemented in this study primarily focused on the children and only included two sessions with the parents. It is recommended to the school and teachers to have a continuous and regular health educational program and promotion about personal hygiene and sanitation to maintain and improve the pupil's knowledge and practice about hygiene and sanitation. A one-day lecture or a long interval between programs may be effective in increasing the level of knowledge but will eventually decline; for practice/behavior, repetition is the key to fostering habits.

Parents are advised methodically to monitor and emphasize good personal hygiene and sanitation at home. Moreover, to set as an example, to be a role model, for their children at home so that re-infection from soil-transmitted helminthiasis and other infectious diseases will not occur. Parents are also advised to participate in the deworming conducted by the school and barangay by giving their consent.

Further, the program implemented in this study primary focused on personal hygiene like hand washing; future programs should still include aforementioned topics and possibly add topic such as street foods. It should also consider expanding the health program to include more environmental intervention as the program implemented in this study had few topics on the matter and did little to develop the environment. It is important to note that health educators should really consider strategies that may foster behavior change and upon implementing the program ensure that the facilitator or lecturer is experienced in interacting with the target population and is fluent in the local language. The module created for this program can be used as a starting point but is suggested by the researcher to improve areas to facilitate behavior change and implement the program over a long period of time and regularly.

Finally, in order to fully grasp the effectiveness of a health program and mass deworming in preventing and control of soil-transmitted helminthiasis, it is recommended that future research consider the duration of the study. The iWASH program failed to see the effect on the practice level of the participant; it was concluded to be hindered by external factors such as culture, community norms and others. Hence, in future research, researchers may consider to determine what specific culture, community norm or any other factors could hinder the acceptance of a behavior in the Philippine setting. Knowing the specific factors could help the health educators implement, create or mix and match some strategies that could better counter those factors hence, lessen their influence.

Conclusion

Soil-transmitted helminthiasis can be prevented and controlled by improving the level of knowledge and hygienic practice through the combination of health education and mass deworming. The iWASH program was successful in increasing the knowledge and self-efficacy of the participants. However, there was only minor effect on the overall practice level of the participants and which was statistically deemed insignificant. The odds ratio showed the experimental group had lower odds of getting infected with helminth than the control group. This study revealed that the synergy effect of health education and deworming in controlling and preventing helminthiasis is observed and highlights the importance of a tailored and sustainable health education program collaborated by the school, the community and the family.

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