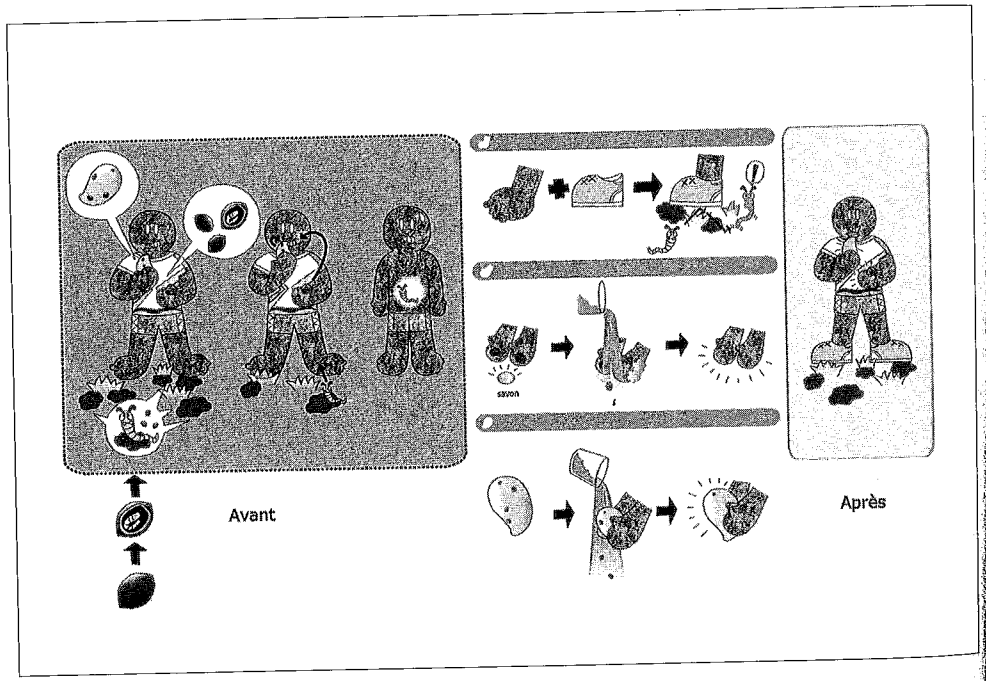





# 3 Designing and Evaluating a Health Program in Africa: *Hygiene Matters*

Mike Zender*, David K. Plate**

* *University of Cincinnati* ** *Hope Educational Foundation*

**ABSTRACT**

Parasitic intestinal worms are a leading cause of poor school performance of children in Africa and a leading predictor of low quality of life for a lifetime. Deworming medication is effective and inexpensive yet experience shows that unless measures to improve hygiene are taken those who are rid of worms through medication are often re-infected within months. Responding to this, Hope Educational Foundation in partnership with a student/faculty design team from the University of Cincinnati designed, developed, and tested a hygiene educational program as part of a comprehensive deworming program in Africa. *Hygiene Matters* was designed with African-user participation, employed visual-story for communication, and was tested in the Central African Republic in 2012 with a larger pilot study in Togo in 2013-14. While hygiene knowledge increased significantly with the curriculum, practices did not increase significantly, and testing revealed flaws in the study protocol that need to be corrected in future evaluations. This project suggests that designers need to improve their ability to conduct research establishing program effectiveness in health outcome terms as designers move from creating individual artifacts aimed to meet client specifications to creating programs that aim to change health outcomes.

KEYWORDS

*visual communication, health program, evaluation, worm infestation*

## BACKGROUND

In 2000 with a remarkable degree of agreement, the United Nations announced Millennium Development Goals. Chief among these was "Achieve universal primary education" because schooling was seen to be a driver of many other development goals: job success, gender equity, mental health, and physical health. One key to educational success is simply attendance, and a surprising driver of poor attendance is worm infestation. Soil transmitted helminthiases (STH) are a group of parasitic diseases caused by infection with nematode worms: primarily roundworm (Ascaris lumbricoides), whipworm (Trichuris trichiura), and hookworm (Necator americanus and Ancylostoma duodenale). These worms are transmitted by eggs in human feces. After maturing in the soil, worm eggs or larvae infect human hosts either through ingestion (roundworm and whipworm) or penetration of the skin (hookworm) (WHO, 2011). It is estimated that approximately two billion people worldwide are infected with these intestinal worms (de Silva, et. al. 2003. WHO, 2013). The burden of disease in Africa is relatively high in comparison to the rest of the world. (WHO, 2011) Infection rates with soil-transmitted helminthes are highest in rural, resource-limited settings, particularly where there is limited access to clean water, adequate sanitation, and improved personal hygiene practices. Where more people are infected, infection spreads to even more people; where fewer people are infected, the worms die out. Freedom from worm infection has been proven to be by far the least expensive way to increase school participation in settings with a high prevalence of worms (Karlan & Appel, 2011, pp. 205-209). Targeting treatment at school children has the added benefit of reducing prevalence in the community at large (Bundy, 1995).

Fortunately, deworming pills exist that are nearly 100% effective and cost just pennies apiece. Unfortunately, successful worm eradication is not as simple as one might wish. Many developing nations lack the funds and public health infrastructure to regularly distribute medication through primary schools. They also often lack health and pharmaceutical facilities, and even if people to whom rapid transit means a bicycle were able to get to a facility, the cost of regular deworming treatment would still be an issue. Worms thrive alongside poverty where clean food and shoes may be luxury items. Worms thrive also in areas with poor sanitation: unclean water and inadequate sewage management. Yet infrastructure improvements are costly, requiring not only funds for construction but also for proper maintenance. Worms are at home in certain social practices: indifference to using toilet facilities and washing hands for example. Finally, worms persist due to historic cultural traditions that can obscure scientific explanations in favor of mythical and mysterious ones; such can block the application of solutions right at hand because people simply don't believe in the solution offered.



Although an inexpensive pill can kill the worms, it is clear from the above that without a change in hygiene knowledge and practices children treated for worms can quickly be infected again. In fact, on a trip to Kenya, one of the authors directly observed that the majority of children dewormed several months previously were indeed reinfected. From this simple need we envisioned a deworming program that would address not only medical treatment but also the ignorance and cultural practices that create the need for continual re-treatment.

## DESIGN DEVELOPMENT

Several leading design voices have called for a move away from an emphasis on designing artifacts. While it may be that knowledge gained from creating and critiquing individual artifacts is essential to the construction of design knowledge and a key feature of design thinking, it also has become apparent that the time for seeing single artifacts as answers to complex problems has passed. The problem of parasitic worms is multidimensional. Neither a pill alone nor a brochure alone are likely solutions. Our response was therefore to design not a single artifact but a multidimensional hygiene education and medication program that included both material artifacts and engagement processes.

The *Hygiene Matters* program aimed to improve the lives of primary school children by teaching healthy hygiene practices and by informing them about deworming medication. The program design incorporated a symbol-based education curriculum to transcend obstacles of literacy and linguistic translation.

The main design object was an instructional hygiene poster for the lower primary classroom (grades 1-3). The poster had just three words: Before - Soap - After. The poster was large (27 x 38.5") so that teachers could refer to it during instruction to a class of a hundred students (large class size is often a reality in Africa). A small 10 x 15" version of the poster was sent home with the students to share with their parents and siblings to further support social/family behavior change. A more detailed 32-page student booklet was designed for upper level primary students (grades 4-6).

A second symbol-based poster for lower primary presented Bible lessons connecting the hygiene lessons to moral values, spiritual purposes, and the value of each individual. Effecting behavioral and in some cases cultural change requires motivation and connection to significance and meaning. We believed connecting physical hygiene lessons to scriptural teachings could provide added motivation and meaning. Though sub-Saharan Africa is predominantly Christian, there are other significant faiths and occasional preferences for no faith, so this specifically Christian content was a separate part of each lesson and was optional for those teachers who wished to use it.

FIGURE 1

**The Hygiene Matters hygiene poster**
This employed primarily symbolic visual communication. It had just 3 words: Avant (Before); Savon (Soap); Aprés (After). The poster tested in the pilot study was in French, the language used in school in Togo. The poster symbolized 6 curricular lessons (from left to right): Lesson 1 What are Worms? (Before); Lesson 2 (middle) Hand Hygiene; Lesson 3 (bottom) Keep Food Clean; Lesson 4 (top) Protect Your Feet; Lesson 5 Always Use a Latrine (not pictured here); lesson 6 Review (After). The poster design evolved over time, changing the sequence of the images on the poster to better match the lesson flow from 1 through 6 and adding a latrine sequence for use of the latrine. This is an earlier version printed for CAR and, because it was readily available, the one tested in Togo.

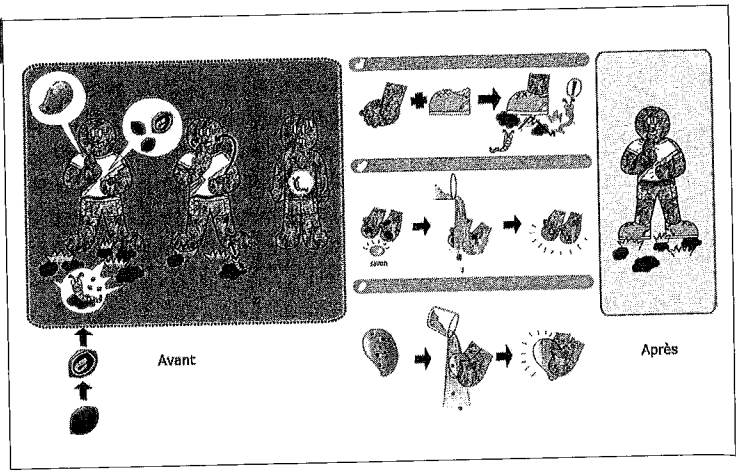
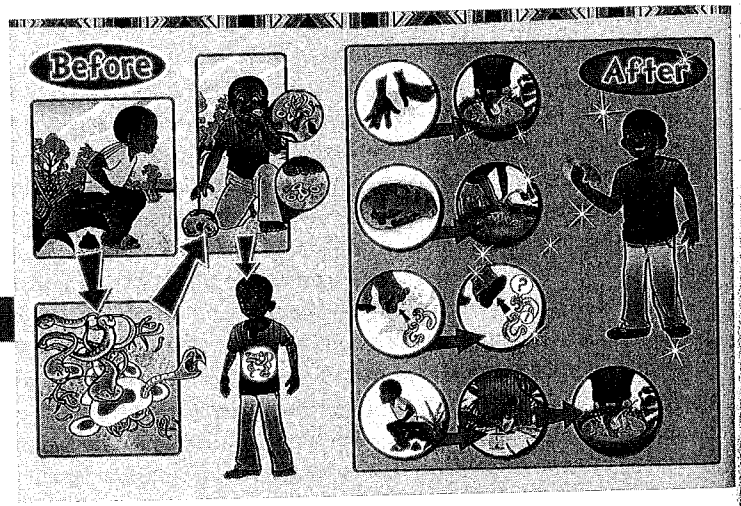



FIGURE 1A

**Redesigned hygiene poster.**
This is a redesigned version of the hygiene poster that included latrine content and responded to on-going struggles among younger children (grades 1-2) to understand worms. This was NOT the poster tested in Togo.




To accompany the students' materials above, a 32-page Teacher's Guide was designed for each curriculum version (lower and upper primary) and a teachers' training program was developed to teach teachers what to teach and how to teach it. Medication would accompany the school-based educational curriculum with appropriate government and community support. Evaluation testing methods and measures for communication design programs are not well established; thus for the pilot study reported here, a pre- and post-program student evaluation of Knowledge, Attitudes and Practices (KAP) was designed along with a teacher feedback survey.



## TEAM

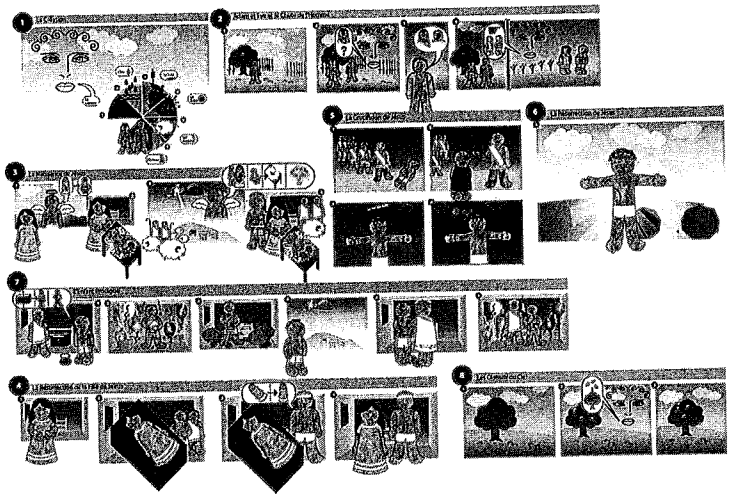
To design a multidimensional program requires a cross-disciplinary team. Our team included staff from the Hope Education Foundation (HEF), a global Non-Governmental Organization (NGO) devoted to addressing systemic threats to children: Emma Moore (Programs Director); Magali Hoffiz (Operations Director); Anna Chard, MPH, Kamila Przystula, MPH, and David Plate, MPH (Research Consultants) and Mike Zender, MFA (Design Consultant & Board Member of HEF, professor of Design University of Cincinnati - UC). This staff included specialists trained in social work, international health, international education, and communication design. Program development was supported by the Hope Educational Foundation. Curriculum and program design support was provided by staff from OneHope, a Christian missions organization: Kami Kindel (Design Team leader), Katie Spencer (Project Manager), Mandie Anderson (Artist & Graphic Designer), and Shannon Medisky (Writer). The program tested in Lome, Togo also had the support of local OneHope staff: Gédéon Attiogbe (Country Director), Jim Byh (Francophone Regional Director), Manuella Bouaben (Monitoring & Evaluation Coordinator), Gilbert Adom and Clement Akahoun (Field Staff), as well as the Togo Ministries of Primary & Secondary Education: Kossi M. Mensah (Health Education Coordinator), and Health: Edmond Sognikin, MD (Community Health Director; Neglected Tropical Diseases Coordinator).

## CO-DESIGN PROCESS

We did not arrive at the program described above quickly or in a single step. We validated the initial program concept and developed content through a literature review of hygiene and STH-related learning objectives and existing curricula, as well as field testing and input from teachers. The resulting curriculum consisted of 6 lessons that may be presented to students over a period of weeks. Our communication strategy was based on our previous experience designing the iMatter HIV/AIDs prevention curriculum in Swaziland that relied heavily on stories for effective communication (Zender, Ecker, & York, 2010). We also learned through the experience that cause and effect, before and after, were not always the most natural explanations for sickness for those still living with a legacy of witchdoctors and ancestor worship. Based on this we sketched visual stories for each lesson emphasizing simple before and after in an apt style employing a generic African look designed to appeal to children. Sample stories were designed in conjunction with UC graduate design student Feifei Pang.

In June 2011 an initial design sketch for the poster was tested in Shariti, Tanzania. A Tanzanian college student administrator was trained to present the poster to a representative student sample of various ages. The administrator first asked students to explain what they saw and then solicited student feedback on what they understood, what they found difficult to understand, and why. In a rural school 18 students grades 1 – 6 agreed to participate. We observed there that older children

FIGURE 2



**The Scripture Lessons Poster.**
Optional lesson portions in the Teacher's Guide link scripture symbol-based stories on this poster to relevant hygiene lessons. Scripture stories 1 and 2 (top row) about God creating all things good and the subsequent fall of man that brought sin and bad worms into the world were linked to Lesson 1 teaching about the dangers of intestinal worms (What Are Worms?). Stories 3-6 on cleansing from sin (forgiveness) were linked to Lesson 2, Hand Washing; story 7 on obedience and making mistakes was linked to Lesson 3, Keep Your Food Clean; story 7 on avoiding bad, particularly negative peer pressure, and doing good linked to Lesson 4, Protect Your Feet; story 4 about growth through consistent faith linked to Lesson 5, Always Use the Latrine; story 8 about spiritual growth and future hope linked to Lesson 6, Review and the positive outcome (After). This poster is in French used in the classroom.

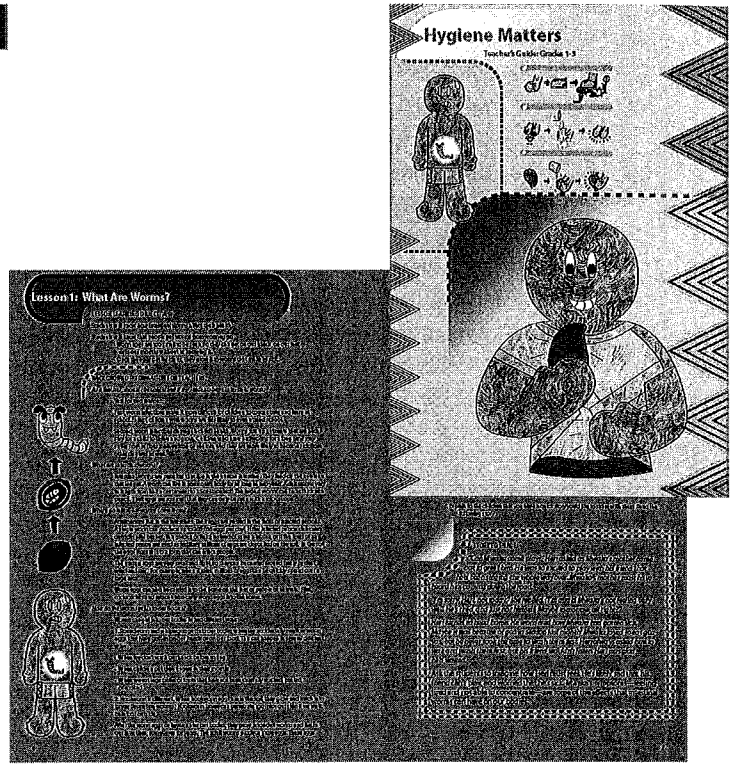
quickly grasped the poster content and then turned and helped the younger children with their questions about it. All students understood the poster content correctly within a few minutes. This suggested that the worm explanation and hygiene messages worked across elementary aged school children. Direct interaction with these children provided an invaluable co-design input.

In May 2012 the program was pilot-tested in two rural and two urban schools in the Central African Republic (CAR). After a half-day training, thirteen teachers taught the program in their classrooms. The six lessons were taught in one week, rather than over three weeks as designed. Evaluation methods included classroom observation of 16 individual lessons, teacher feedback surveys, post-program teacher focus groups, student KAP pre- and post-testing, and student art preference testing. Additional valuable feedback was provided by collaborators from a partner church in France who assisted with the validation, as well as by a government panel of health and education experts who reviewed the curriculum. Unfortunately, student KAP pre- and post-testing was interrupted by teacher strikes during the final week of the validation, so it was not possible to evaluate the program's impact on students.

Some of the key revisions resulting from the CAR pilot-testing included choosing more appropriate titles for the overall program and the lesson sub-sections, adapting lesson activities to make them more locally feasible, and improving illustrations to better convey hygiene messages. Later in 2012, the CAR Ministry of Primary and Secondary School Education & Literacy chose to not grant approval to implement the curriculum more widely in public schools throughout CAR, despite earlier indications that approval would be granted. In retrospect, it would have been impossible to continue conducting the program in CAR due to political instability lasting from late 2012 to the present.



FIGURE 3




**Teachers Guide: cover and pages 6-7.**
The cover summarizes the poster, with the Before in the upper left and the happy After in center right with three lessons in upper center. Pages 6-7 show how the poster symbols were repeated throughout the Teachers' Guide. Page 7 gives an example of a story used in teaching. Lessons also included hands-on activities. The Teachers' Guide included Teaching Tips and other teaching resources. Pages 34-35 of the guide reproduced the poster and showed how each lesson was illustrated on the poster and how to use it in instruction. The Teachers' Guide for the pilot was in French. This figure is in English.

Due to the difficulties in CAR, in 2013 we moved the pilot test to Togo. Togo was chosen for two reasons. First, STHs are endemic in Togo. Biological field surveys in Togo demonstrate a prevalence of STH infection above 50% in locations throughout all regions of the country (Global Atlas of Helminth Infections; Dorenoo, 2012). Second there is a strong existing relationship between Hope Education staff, the local Assemblies of God Church, and the government which necessarily facilitates implementation of any school-based education initiative. It was agreed with the Togo Ministry of Education that individual teachers would be allowed to not teach the Bible portion of the lessons if that was their preference.

## METHODS

The *Hygiene Matters* program was validated in 2013-14 as part of a pilot program in 5 districts in the capital of Togo, Lome. The study had three objectives:

1. To evaluate whether the *Hygiene Matters* program was implemented as intended,
2. To evaluate the impact of the *Hygiene Matters* curriculum on the hygiene-related knowledge, attitudes, and practices (KAP) of school-aged children,

3. To obtain feedback from teachers regarding the curriculum content and ease of use,

We also explored the program's impact on self-reported sanitation conditions in students' homes.

Starting in October 2013, Hope Education Foundation sponsored a bio-survey estimating the prevalence of STH infection in 30 schools in the study area that were expected to have the highest prevalence based on sanitation conditions and other factors (Dorkenoo *et al.* 2014). From among the 18 schools with the highest rates of STH infection, 12 were randomly assigned to the education group (to conduct the *Hygiene Matters* program), and 6 were randomly assigned to the control group. These 18 schools comprise the validation study. Student KAP pre- and post-testing was conducted among 2590 students in these 18 schools.

TABLE 1

**Pilot program & validation study comparison**

| | Pilot program | Validation study |
|---|---|---|
| Number of schools | 298 schools | 18 schools (including 12 of the schools participating in the pilot program, and 6 additional control schools) |
| Grades involved | Grades 1-6 | Grades 3-6 |

TABLE 2

**Study objectives and measurement tools**

| Objective | Measurement tool(s) | Timeframe for administering | Participating schools |
|---|---|---|---|
| 1. To monitor implementation of the Hygiene Matters program. | Teacher training attendance & feedback form<br>Distribution of materials form<br>Class size & student attendance/registry forms, by lesson | Throughout the pilot program | All 298 pilot schools |
| 2. To evaluate the impact of the Hygiene Matters curriculum on students' hygiene-related KAP, including self-reported sanitation conditions in students' homes. | Student KAP pre-survey<br>Student KAP post-survey 1<br>Student KAP post-survey 2 | Immediately before the intervention<br>One month after the intervention<br>Four months after the intervention | 12 pilot schools (education group)<br>6 control schools (control group) |
| 3. To obtain feedback from teachers regarding the curriculum content and ease of use. | Hygiene Matters lesson feedback form | At the end of the teacher training<br>At the end of each of the 6 lessons | All 298 pilot schools |



The overall pilot program involved an additional 286 schools, for a total of 298 schools conducting the *Hygiene Matters* program. Program monitoring forms and teacher feedback forms were collected from all 298 participating schools.

## TEACHER TRAINING

Teachers in all participating schools were trained on the *Hygiene Matters* curriculum. Teacher training was conducted by a team of 12 Togolese facilitators. Facilitators were trained in August 2013 by Hope Education Foundation's Research Consultant and Operations Director, and then facilitators conducted a practice training in September.

Teachers were trained on the information that should be presented during each *Hygiene Matters* lesson. It was made clear that teachers were allowed to not teach the Bible portion of the lessons if that was their preference. Teachers in all 18 evaluation schools received additional training on how to conduct the KAP pre- and post-testing. Teachers in the schools in the education group received the *Hygiene Matters* materials necessary to implement the educational intervention, including teachers guides, student books, and posters while teachers in the control group schools attended the trainings but did not receive the materials or implement the curriculum during the study period. Educational materials were distributed to students in the control schools at the end of the school year, following the final KAP survey.

## VALIDATION STUDY POPULATION AND SAMPLE SIZE

The study population consisted of school-aged children in grades 3-6 in selected primary schools in Lome. Based on pilot testing of the survey, children in grades 1-2 were unable to complete the written KAP survey, and one-on-one interviewers were not feasible.

The number of students included in the KAP pre- and post-surveys was sufficient for estimating KAP scores with 95% confidence and a 5% margin of error within each study group (education, control) as well as by grade. Students KAP scores would be expected to be more similar within the same classroom and school than across different classrooms and schools. Therefore, the required sample size for estimating KAP scores is mainly a function of the number of schools and classrooms, rather than the total number of students. However, it was only feasible to sample from approximately 6 schools per study group rather than the optimal 60+ schools. Therefore, school- and classroom-level clustering was ignored when determining the sample size.[1]

The KAP test was conducted in one classroom per grade in each school. The required sample size could have been reached by randomly selecting students to test in each classroom; however, it was easier

[1] Implications are explained in the Data Analysis section, below.

to give the KAP test to all students in a class. Therefore the total number of students in the sample was larger than necessary.

## PROGRAM MONITORING

At each teacher training session, attendance was taken and teachers provided written feedback. During the program, all teachers in all participating schools were asked to provide the following information:

For each *Hygiene Matters* lesson: lesson date, number of students (total, male, female), and feedback on lesson content (positive/negative aspects, most difficult concepts, utility, suggestions for improvement, and success stories)

For each participating student: name, sex, age, attendance at each lesson

## KAP & HOME SANITATION SURVEY

Each participant within the 18 selected schools completed a survey focused on knowledge, attitudes, and practices (KAP) related to hygiene and STHs. The KAP survey was pilot tested in 2012 in the previous validation in the Central African Republic. KAP surveys were administered pre-intervention, 1-3 weeks post-intervention, and 10-13 weeks post-intervention. (Intervention refers to the implementation of the *Hygiene Matters* curriculum.)

The KAP survey consisted of true and false, and multiple choice questions addressing basic information about STHs, transmission mechanisms of STHs, and ways to prevent STH infection. In addition, as an exploratory outcome, additional questions on the KAP survey evaluated standards in home sanitation as reported by students and measured any changes over the course of the evaluation period. Home sanitation topics included access to shoes, clean water, soap, and a latrine.

Scores for the KAP questionnaire were calculated out of a total of 19 points, excluding the home sanitation section which was a total of 4 points. Scores are presented as the percent of correct items in each section or overall. Scores are reported only for those students who completed all 3 KAP tests.

## DATA ENTRY & QUALITY CONTROL

Data was originally collected on paper-based surveys which were transcribed into an Excel database.

Basic monitoring information was entered from all schools, and complete information was entered from a sample of schools (the 12 schools in the education group, and 10 randomly selected control schools) for in-depth analysis. It was not necessary or feasible to enter and analyze all the monitoring data collected from all program schools.

For quality control, a small subset of each survey or form (e.g. 10 participants for each of the KAP surveys) was entered twice and the two entries were compared. In all cases the error rate was below the predetermined 5% threshold, and in most cases the error rate was below 2%. No significant data entry problems were identified.



## DATA CLEANING & ANALYSIS

For the KAP surveys, we excluded 7 students who were assigned to different schools for different KAP surveys. Statistical analyses were conducted using STATA v12 and SPSS v22. Independent samples t-tests were used to test for differences in post-means among study groups. Differences at a 90% confidence level (p-value below 0.10) were considered statistically significant, meaning we are 90% confident they did not occur by chance.

For the KAP analysis, when baseline scores differed between the education and control groups (and due to the non-normal distribution of the data), it was not possible to statistically test for the differences in these average values between the education and control groups.

Although students were grouped within schools, a multi-level analysis (to account for grouping within schools) was not done because it would have limited statistical power due to the small number of schools. (It was not feasible to sample from a larger number of schools.) Therefore, it may not be possible to generalize the results to all schools in the program area.

## TREATMENT

In November 2013 a bio-survey was conducted. The prevalence of intestinal worms was below the 20% threshold established by WHO, so medication was not administered to all students as part of the program. All participants who tested positive for STH in the bio-survey received treatment. The medication was administered at each of the schools where participants who tested positive were enrolled and consented to obtain treatment.

## IRB APPROVAL, INFORMED CONSENT, AND CONFIDENTIALITY

The Ministry of Health Ethics Committee in Lome, Togo approved the study prior to the start of data collection. Written consent was provided by the parents/guardians of potential participants in the bio-survey. The consent forms were sent home with each student prior to the bio-survey. Only students who provided a signed parental/guardian consent form were eligible to participate in the study.

Student and teacher names were collected during monitoring and evaluation activities for the sole purpose of linking information across different forms (e.g. linking KAP pre- and post-tests). Access to data was limited to HEF program staff conducting data entry or analysis.

## RESULTS

The aim of the *Hygiene Matters* program was to reduce the community-wide infection of worms through a combination of medical treatment and health education. The pilot program and validation study were designed to demonstrate program effectiveness directly through change in KAPs and indirectly through a lower instance of worm reinfection in the intervention group that received the curriculum. Unfortunately for the study, the bio-survey showed the initial worm prevalence was lower than expected (below 20%) and thus administering medication to all students was not permitted as part of the pilot program. As a result, it was not possible to conduct a post-survey of worm prevalence thus thwarting our ability to measure worm reinfection rates and the effectiveness of our program on the ultimate outcome.

## PILOT PROGRAM MONITORING

### Teacher Training

A total of 1160 teachers from 298 schools in Lome were trained on the *Hygiene Matters* curriculum. On average, 3.9 teachers were trained per school. Seven training sessions were conducted from November 25 to December 15, 2013, with a range of 106 to 195 (average: 163) teachers per session. An eighth training session with 20 remaining teachers was conducted on January 28, immediately before the start of the program.

Due to budget constraints, it was not possible to train enough teachers for the original goal of reaching 100,000 students with the program.

### Program implementation

Enough *Hygiene Matters* materials were distributed to 298 schools to reach 73,762 students, including 38,987 lower primary students (grades 1-3) and 34,775 upper primary students (grades 4-6).

### Reported Number of Students Reached

One or more program monitoring forms were submitted by 931 teachers representing 1008 classrooms in 263 schools. This represents 80% of the 1160 teachers who were trained and 88% of the schools with trained teachers.

The *Hygiene Matters* curriculum was implemented across the participating schools from January 30 to March 17, 2014. Starting and ending dates varied considerably across schools. On average, the six lessons were taught over a period of 3 weeks (21.3 days) (range: 11-33 days), which is in line with the plan of teaching 2 lessons per week.

Reporting forms submitted by teachers account for 58,879 students being reached by the pilot program. This represents 80% of the 73,762 students who were potentially reached based on the quantity of materials distributed to schools. On average, there were 58.4 students per class.



### *Hygiene Matters* Lesson Implementation

Program monitoring data were analyzed in more detail in a sample of 22 schools, including the 12 schools in the education group of the evaluation and 10 additional, randomly-selected program schools. In total, 99 (98%) of the 101 teachers in this sample taught all 6 of the lessons. Two teachers taught only 5 of the 6 lessons. On average, students attended 5.8 out of the 6 lessons, for a 97.5% attendance rate. Attendance varied very little by age or sex. Teachers reported only 1.4 absences per lesson, on average. The average number of absences was highest for grade 1 (2.1) and lowest for grade 6 (0.6). Each lesson lasted an average of 42 minutes. Lessons 1 to 6 were all very similar in length. However, lesson length gradually increased with grade level. Each Lower Primary lesson was 3 to 6 minutes shorter, on average, than the corresponding Upper Primary lesson.

## KNOWLEDGE, ATTITUDES, AND PRACTICES (KAP)

A total of 2560 students participated in all three KAP surveys.

### Demographics

There were no significant differences in the age or sex distribution of students across the three rounds of KAP surveys.

### KAP Survey Results

At baseline (pre-survey), the education and control groups had the same average KAP score (see *chart 1*). Within one month after the intervention (post-survey 1), the average KAP score was significantly higher in the education group. At 2-3 months post-intervention (post-survey 2), the education and control groups had similar average KAP scores.

Chart 1, below, shows the improvements in the overall KAP scores in the education group relative to the control group. These were due primarily to improvements in knowledge scores, not to improvements in attitudes or practices scores.

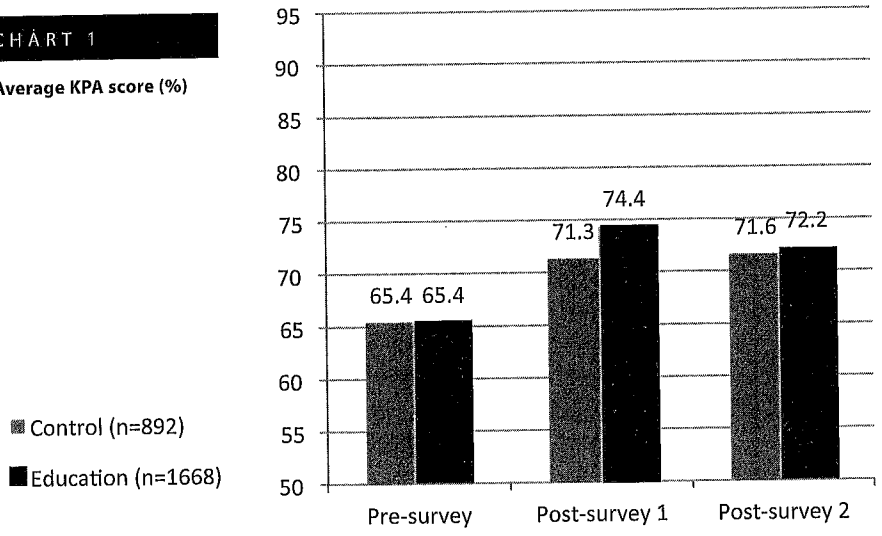
Overall KAP pre- and post-survey scores for the education and control groups

At baseline (pre-survey), the education and control groups had the same average KAP score. One month after the intervention, the average KAP score was significantly higher in the education group. At four months post-intervention (post-survey 2), the education and control groups had similar average KAP scores.

From pre-survey to post-survey 1, average Knowledge scores increased to a much greater degree in the education group than the control group. A similar increase was seen from pre-survey to post-survey 2.

CHART 1

**Average KPA score (%)**




From pre-survey to post-survey 1, changes in average Attitude scores were similar in the control and education groups. From pre-survey to post-survey 2, the control group actually showed a greater increase than the education group.

Last, the control group showed more improvement over time in average Practices scores, compared with the education group.

## TEACHER FEEDBACK

Program monitoring forms included the following open-ended questions for teachers:

What went well in this lesson?
What went poorly in this lesson?
Were any concepts not understood by the students? If so, which ones?
How could this lesson be improved?
Comments (general comments about the program)

We reviewed a sample of responses from 95 teachers, representing 27 schools. Most teachers provided feedback on all 6 lessons, so there were approximately 600 responses to each question.

### "What went well in this lesson?"

In total, 68% of responses to this question were substantive. 30% of responses reported that everything went well, and only 2.5% "nothing". Responses weren't analyzed in detail, but some common responses follow:

*Students were interested, were motivated, took the content to heart, actively participated, etc.*
*Handwashing and other activities were good*
*Students like the lessons, were proud of their books, etc.*
*The images, posters, and Bible stories were helpful*



### "What went poorly in this lesson?"

Teachers reported no problems in 85% of the lessons. The most frequent problems had to do with the Biblical content in the lesson.

### "Were any concepts not understood by the students? If so, which ones?"

Remarkably, teachers reported that no concepts were misunderstood in 89% of the lessons. This is inevitably an underestimate on the part of teachers, but it is still encouraging.

Teachers in grades 1-4 reported that children had difficulty grasping the existence of intestinal worms. Older students (grades 3-6) struggled more with understanding how worms infect people.

Some students lacked basic hygiene knowledge, such as how to use a latrine and how to properly wash hands.

### "How could this lesson be improved?"

52% of teacher responses gave no suggestions for improvements. 20% of teachers suggested specific curricular changes such as "show a film" and 20% requested additional materials such as soap for hand washing and other activities in the lessons.

### General Comments

General comments from fifty teachers were reviewed. The few negative comments from teachers have all already been mentioned in previous comments above. A sample of some of the positive comments follow:

*This project is welcome. It allows students to know the rules of hygiene that they must follow to be in good health.*
*This is a good program. Over the course of the lessons, the students were amazed at the harm worm [eggs] cause to people.*
*I salute your initiative since we live in a region with a high population density, confronted with parasitic diseases... Through these lessons, students can adopt good hygiene measures.*
*I wish we had more books to distribute to the students, as well as Bibles.*
*The lesson connected with God's Word interested the students.*
*We're proud of what you have given us. It's a plus.*

## DISCUSSION

### Program Design

The poster and curriculum design increased knowledge. While younger children continued to have problems understanding the size of the worms

this may be simply an obstacle presented by use of the word "worm" in society/medicine both for something large we can all see in the ground and for something microscopic that grows larger inside your body. Design can facilitate understanding of difficult concepts but cannot change the nature of the concepts or change the language society has developed to describe them.

The image-based visual story approach was effective as was the simple before and after structure. It was not surprising that some problems were reported with the Biblical visual stories because there were not only more Bible stories, but each one was also more complex and longer than the simpler worm stories.

The teacher training was also effective, as discussed below perhaps too effective! The Togolese facilitators readily grasped the curriculum content and the visual stories used to convey it. In fact, anecdotal experiences suggest the symbol-based content likely made the program content easier to not only grasp for students but also easier to remember, explain, and deliver for facilitators and teachers alike. Results certainly identified no problems in knowledge transfer from program staff to facilitator to teacher to student.

The visual approach was also appealing to teachers and students alike, likely adding to its effectiveness.

In short, the program design and individual design objects in it were effective.

### Evaluation Design

Even given the overall effectiveness of the program, it was still surprising that the KAP scores increased in the control group as well as the education group. There are several possible explanations for why.

First, KAP tests were administered by the teachers, mostly unsupervised by HEF or OneHope personnel. Therefore, it's possible that teachers may have coached the students when giving the KAP tests. This sometimes happens when teachers want their students to perform well on a post-test, even though they have been told that the purpose of the testing is to evaluate and improve the curriculum, not to evaluate the teacher or his/her students.

If coaching was taking place, it becomes impossible to accurately evaluate the effectiveness of the curriculum because coaching could inflate the KAP test results in the control schools, the education group schools, or both.

In future evaluations, all KAP tests should be given by program personnel, not by teachers, even if it means having a much smaller sample size. (In this validation, we opted for a larger sample size, although it meant we couldn't oversee testing in all classrooms.)

Second, teachers in control group schools participated in the teacher training along with teachers in the education group,



in order to prepare all teachers to administer the KAP tests. Since basic information on hygiene and intestinal worms was included in the teacher training, it's possible that teachers in the control schools may have passed along information about worms and hygiene to their students. If this was the case, it appears that the teachers conveyed the material quite effectively without the HM curriculum, although using the curriculum did have an additional impact (see Chart 1, above).

In future evaluations, teachers in the control group schools should not participate in the teacher training. If KAP testing is done by program staff, then there will be no need for teachers in the control group to be trained.

Third, students sometimes score better the second or third time they take a test simply due to familiarity with the test, even if they haven't learned any additional material. This effect might be more pronounced from the pre-survey to post-survey 1 where the interval was only 5-7 weeks, whereas the drop in scores from post-surveys 1 to 2 may be due to the longer interval (9-10 weeks) between those surveys. The purpose of the control group is to measure this effect. Thus, if the improvement in control group scores is due to this retesting effect, then any additional improvement in the education group (over and above the improvement seen in the control group) can be attributed to the curriculum.

Some additional preliminary analysis results (not presented here) indicate that the KAP scores varied significantly depending on who the teacher was. This might mean that the first and second factors above may have been occurring (since some teachers may be more likely to coach students than others or to voluntarily pass along hygiene information to their students), or it may simply indicate that teaching effectiveness varies a lot from one teacher to another. Future evaluations can be designed so as to minimize first and second factors above.

## CONCLUSIONS

The *Hygiene Matters* program was found to be effective at increasing hygiene-related knowledge over the short term, but the program's impact was lower than expected in terms of (1) altering attitudes and practices (not just knowledge), and (2) effecting change over a longer period of time.

Several recommendations were made to increase the program's impact:

- Ensure the posters stay up on the classroom walls both during and after the program, rather than being taken down between lessons and/or after the lessons were completed. This will provide more opportunities for repeated exposure (both casual and intentional) to the lessons' content.

..... Add 3-4 short (e.g. 30-minute) follow-up activities at 1, 2, and 4 month intervals after the initial lessons to reinforce the poster/curriculum content and learning. This could involve story-based lessons, transfer activities, incentive-driven quizzes, etc.

..... Add more hygiene practice time. This could also be incorporated into follow-up/refresher activities after the initial course.

The program's effectiveness may have been underestimated due to problems with how the research was conducted. The following recommendations were made for improving the research protocol:

..... Don't train control group teachers (to minimize the transfer of hygiene knowledge to students in the control schools).

..... Use staff to administer tests thus improving control (to eliminate the possibility of coaching during testing).

..... Modify post-test design to educate less.

Evidence that the program may be more effective than testing would indicate came recently from Country Director Gédéon Attiogbe who related that when the Togolese government was doing public health education campaigns around the Ebola outbreak last year, the *Hygiene Matters* schools kept telling them "Hope Education already taught us this!"

From this project it appears that design in partnership with health professionals and education specialists can produce effective health programs, but that better outcome evaluation is needed to demonstrate effectiveness. It would be unfortunate if a good program were to languish because its measure of effectiveness was compromised through flaws in the evaluation testing. In our view, if the discipline of Design is to be a partner in developing health program interventions then Design must demonstrate skill not just in the creation of effective individual artifacts and not just in the design of effective programs that include effective individual artifacts but also in the design and execution of evaluation testing to accurately measure the effectiveness of program outcomes.



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## AUTHORS

### Mike Zender

Mike Zender is Professor of Design at the University of Cincinnati. His research centers around non-verbal communication through symbols and icons in the medical domain, and the application and testing of these in global cross-cultural communication. A third generation typesetter and designer, Mike previously founded and operated the design practice, Zender + Associates, Inc. where for thirty years his work and that of his associates was published regularly and exhibited broadly. He received his MFA from Yale University where he was the Carl Purrington Rollins Fellow. In 2004 he was a Medical Informatics Fellow at the Marine Biology Laboratory, Woods Hole, MA, in 2009 was named a National Fellow of the AIGA (American Institute of Graphic Arts), and in 2013 was named a Graduate Research Fellow of the University of Cincinnati.

### David Plate

David Plate has been the Research & Evaluation Coordinator for Hope Education Foundation since 2011. In this role, he has focused on developing and evaluating the *Hygiene Matters* curriculum for francophone Africa. He is also part of the Research Team for OneHope. He previously worked as an epidemiologist with the Chicago Department of Public Health and the U.S. Centers for Disease Control & Prevention. He earned his Master of Public Health degree from the University of Michigan. David grew up as a missionary kid in West Africa.