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Evaluation of a global training program in One Health communication

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Abstract

Aim: A global Train-the-Trainer Program, focused on improving the communication techniques of One Health advocates, is assessed and evaluated in this study.

Methods: Between November 2020 and November 2022, a Train-the-Trainer Program engaged 1.583 trainees from 98 countries between the ages of 18 and 74. Trainees practiced public speaking by teaching a lesson about One Health in mostly underserved primary school classrooms. Two surveys of trainees (n = 222 and 203) assessed the impact of the Program's orientation session on their confidence in science communication to a novice audience. The classroom teacher survey (n = 184 teachers, representing 4.109 students) measured the trainee's impact at the community level during and following the lesson.

Results: The Program significantly improved the trainee's confidence in communicating science (0.1 scale points) and teaching novice audiences (0.3 scale points) about One Health. Trainees cultivated student interest in One Health [median = 9 (7.3, 10)] and 90.8% of responding classroom teachers reported a desire to continue teaching about One Health after the trainee's lesson, 99.1% noted a post-lesson increase in student interest in science, and 97.4% recommended this lesson to their colleagues.

Conclusion: This study was the first to evaluate an extensive One Health-focused communication program finding the model effective for trainees and communities alike. The trainees, through public speaking, active teaching and

engaging mostly primary school students, mainstreamed One Health and inspired action in communities. The classroom teachers benefited by learning about One Health and gained a desire to share this new knowledge with others in their community.

Keywords: Education, one health education, STEMM education, interdisciplinary education

INTRODUCTION

One Health is currently described as "an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals, and ecosystems. It recognizes the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and interdependent"[1]. The term "One Health" arose from a "One World, One Health" conference hosted by The Wildlife Conservation Society at Rockefeller University in 2004. Since then, the term has undergone several variations and has been interpreted as a concept, an approach, or both by different academic institutions and leading figures, which has led to both debate and evolution[2,3]. In order to fully appreciate the One Health (OH) approach and the current definition as accepted by the United Nations' Quadripartite[4] (consisting of the World Health Organization, Food and Agriculture Organization, World Organization for Animal Health, United Nations Environment Program) and its corresponding infographic, as seen in Figure 1, novice audiences must first understand the OH concept. The OH concept describes the critical interconnection between the health (and wellbeing) of people, animals, plants, and the environment (including ecosystems). The OH approach, however, relies on teamwork (including communication, collaboration, coordination, and capacity building) between different stakeholders to prevent and respond to OH challenges. By taking this step-by-step approach in describing OH, a novice audience can readily comprehend the contextual meaning, regardless of their age or background[5].

It should, however, be noted that even the concept of OH currently has two streams of thought: one that primarily focuses on the reduction of health risks at human-animal-plant-environment interfaces and another that shifts the focus to system-level analysis of interface linkages and their underlying structures and drivers[6]. These OH paradigms demonstrate the breadth of the concept, but are overwhelming to a novice audience. For instance, terms in the Quadripartite's infographic [Figure 1] such as "capacity building", "sectors" and "disciplines" may require further explanations and, consequently, detract from the overall message and buy-in of OH with novice audiences[5].

Although OH is recognized by many national, bilateral, and multilateral organizations, it still has room to grow among the public as well as policymakers and academics. Indeed, the road is still long before the OH concept is fully incorporated and its approach is fully implemented in communities. While the Quadripartite[4] and the recently updated Core Competencies for OH[6] emphasize the need for strong communicators in the OH workforce, and relatively few OH-focused organizations actively train OH trainees in communication techniques such as public speaking. However, One Health Lessons (OHL) is one such organization working to address this gap. Its Train-the-Trainer Program (TTP), known as its Certified Lesson Leader Program (CLLP), teaches volunteers ("trainees") communication and teaching techniques that are then applied in traditional and non-traditional classroom settings, usually within primary schools where novice audiences consist of young students and their full-time teachers. This study's objective was to assess and evaluate the impact of this TTP's communication training on both the trainee and the novice audiences (including both students and their full-time teachers).

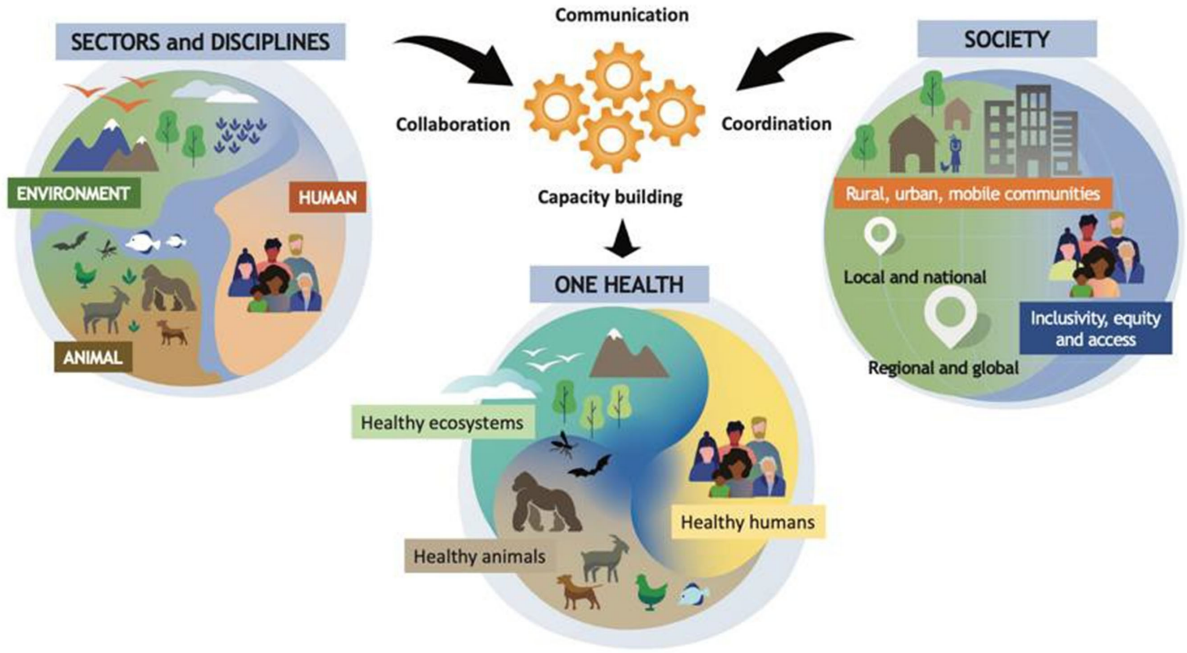

Figure 1. One Health toward a sustainable healthy future as developed by the One Health High Level Expert Panel, and accepted by the United Nations' Quadripartite. Source: Adisasmito WB *et al.*[1].

METHODS

The voluntary TTP, implemented by OHL, is designed to improve a trainee's effectiveness and confidence in communicating OH topics to various novice audiences and stimulate action at the community level. Between November 2020 and November 2022, a total of 1.583 individuals from 98 nations enrolled in its CLLP; all trainees must be at least 16 years old and are subject to a randomized background check prior to introducing them to a classroom or group of students. In addition, the trainee may come from any educational background, discipline, or sector.

The CLLP consists of four stages of training [Figure 2] after recruitment. The CLLP starts with a 1-hour orientation session where thought-provoking and action-inducing communication techniques are taught to trainees. The orientation is conducted virtually or in-person by either the organization's Founder, who has a 20-year history of teaching different subjects to various ages, or an OHL Ambassador, as later described. Before and after this orientation session, an anonymous and optional self-assessment survey [Supplementary Material 1] gauges the trainee's comfort level on various subjects, including (1) teaching a class of 10-year-old students; (2) overall science communication skills; (3) overall teaching skills, using a Likert scale ranging from no confidence (1) to very confident (5). In addition, the trainee is asked about the age at which he/she first became interested in STEMM (Science, Technology, Engineering, Mathematics, or Medicine of all forms).

Following this step, trainees watch a 1-hour recorded online lesson and pass an exam that focuses on age-appropriate communication and teaching techniques for novice audiences; afterward, trainees observe a virtual or in-person 1-hour live OH lesson with a group of students present, and then teach a 1-hour OH lesson to students while the classroom's full-time teacher evaluates the trainee's delivery of the lesson by completing an optional and anonymous assessment survey [Supplementary Material 2]. In addition, this teacher survey collected information including whether the full-time classroom teacher would recommend

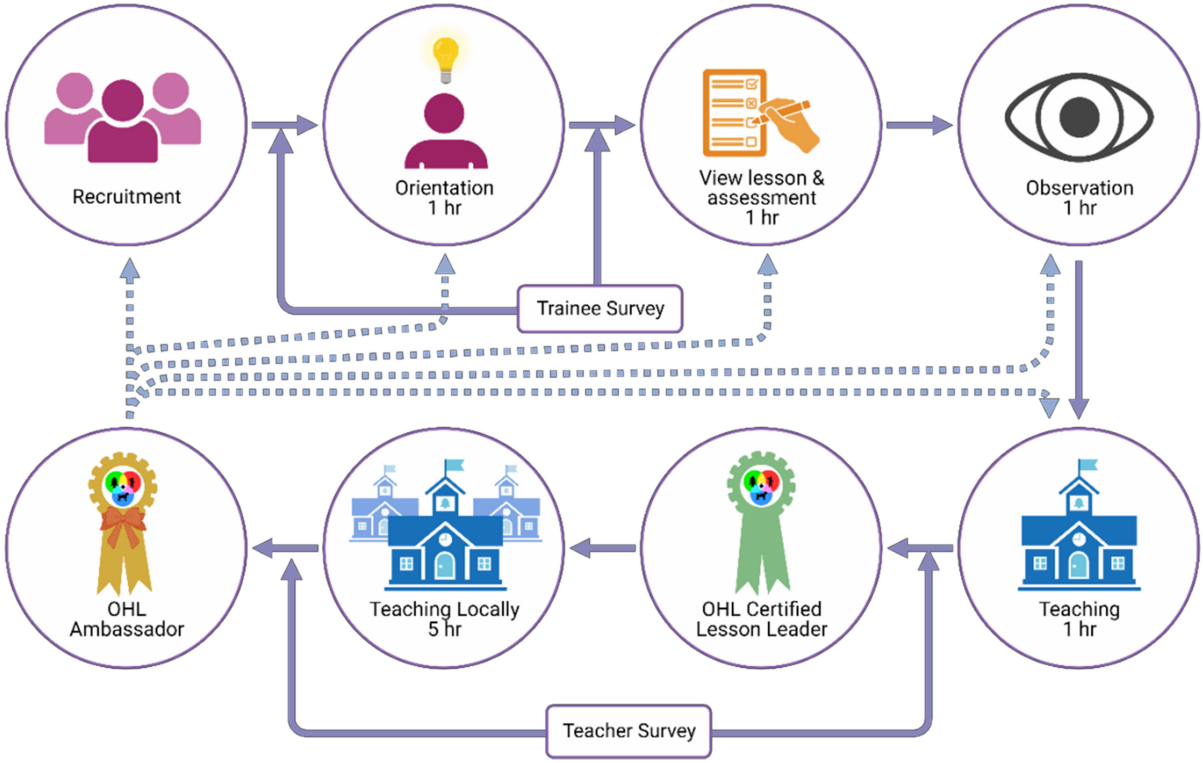

Figure 2. The stages of the Certified Lesson Leader Program (CLLP) associated with One Health Lessons (OHL)[7]. Trainees are recruited through local outreach and social media. Voluntary and anonymous survey of trainees is conducted during pre- and post-orientation training. Afterward, trainees watch a recorded lesson and pass an exam, then attend a live lesson, then teach a lesson with a novice audience. Trainees are then certified as OHL Certified Lesson Leaders (CLLs) and are expected to locally teach five lessons to become an OHL Ambassador. OHL Ambassadors act as recruiters and trainers for local OHL CLLs. Created with BioRender.com.

the lesson to their colleagues, continue to teach about OH, and consider purchasing supplemental OH learning material. In addition, it asked the educators about the degree of classroom engagement and the extent to which the lesson influenced the students' overall interest in science. These survey results were monitored to avoid duplicates. In total, full-time classroom teacher surveys from 184 classrooms were evaluated in this study.

Overall, the expected training process to become a Certified Lesson Leader (CLL) takes four hours to complete and incorporates two hours of active learning, observing and being examined on effective communication techniques for novice audiences and a second two hours of observing and implementing those communication and teaching techniques in a classroom [Figure 2]. Once trainees complete these four hours of training, they become certified and are expected to teach at least five lessons about OH in their local communities, using their local language(s). After the fifth lesson is taught, the individual gains the title of "OHL Ambassador". The main responsibility of OHL Ambassadors is to train other trainees, using the aforementioned CLL four steps, in their first language, thereby creating a robust local network of CLLs and OHL Ambassadors who are proficient in communicating complex OH topics to the general public, colleagues, and stakeholders[7]. During the study's duration, all OHL Ambassadors were either pursuing their higher education degree or working professionals.

During the study's 24-month period, the vast majority of trainees fulfilled their third and fourth hours of training [Figure 2] with virtual lessons due to the ongoing COVID-19 pandemic. This was made possible

through a partnership with Community Resources for Science (CRS), an educational organization based in California[8]. Access and entry to the classrooms were by invitation only through the full-time classroom teachers associated with CRS[8] and the majority of classrooms consisted of 8 and 9-year-old students in California. Therefore, the virtual lessons often connected trainees from 98 nations [Figure 3] with classrooms in another part of the world, thereby improving the cultural awareness of students and trainees alike, as noted by full-time classroom teachers[9].

Statistical analyses

Data was compiled and descriptive and statistical analyses were performed using GraphPad Prism, version 9.0.0. Non-parametric analyses were required for all tests due to the non-normal distribution of values and the ordinal nature of some variables. For analysis of trainee ages between regions, one-way ANOVA was performed with subsequent Mann-Whitney U test between groups, with a significance threshold adjusted with the Bonferroni correction. The significant difference between groups was demonstrated by compact letter display. Mann-Whitney U tests were performed for all trainee survey answers to determine the scope and significance of differences before and after the OHL orientation training. Geographic projection of countries represented was generated using Mapchart.net.

RESULTS

Demographic surveying

Between November 2020 and November 2022, 1.583 personnel between the ages of 18 and 74 enrolled in the CLLP [Table 1]. There were significant yet minimal variations in the age of trainees enrolled between regions, with all groups having a median age of trainees between 23 and 27 years old, except for the marginally represented Oceania with a median age of 35. The enrolled trainees came from 98 different nationalities and autonomous regions [Figure 3]. The enrolled trainees' nationalities included 15 from Asia, 5 from Central America, 21 from Europe, 22 from the Middle East, North Africa and Greater Arabia (MENAGA), 3 from North America, 2 from Oceania, 4 from South America, and 26 from Sub-Saharan Africa. After statistical analysis, participant ages between the regions of Asia and MENAGA were not significantly different from one another (cluster a), while North America, South America, Europe and Sub-Saharan Africa were likewise not significantly different from one another (cluster b), but were from Asia and MENAGA. Oceania and Central America were outliers, as no regions from either cluster were significantly different from them (cluster ab).

Further, the trainees represented 14 disciplines [Table 2] based on their professional vocation or their field of study. The largest proportions of trainees were those in the field of health (58.3%), while sciences and humanities constituted minor proportions (15.5% and 7.1%, respectively). After the collection of demographic data, trainees were scheduled to participate in the CLLP.

Training outcomes

Before and after the orientation training, survey participants responded to questions [Supplementary Material 1] regarding their confidence in active teaching and science communication to young audiences and their age when they first contemplated a career in STEMM.

Out of the 1.583 enrolled trainees, 222 (14.0%) adequately completed the optional and anonymous self-assessment survey before the orientation session began and 203 (12.8%) sufficiently completed the optional and anonymous survey after the orientation session.

Table 1. Age ranges and descriptive statistics of enrolled CLLP trainees according to geographic region

Region	Participants (*n*)	Age (years old)					
		Min	First Quartile (25%)	Median	Third Quartile (75%)	Max	CLD
Sub-Saharan Africa	615	18	23	25	29	74	b
MENAGA	455	18	22	24	28	59	a
North America	178	18	23	26	35	64	b
Central America	12	23	25	27	30	51	ab
South America	24	23	25	26	32	45	b
Asia	162	18	22	23	27	66	a
Europe	133	18	23	26	35	60	b
Oceania	4	26	30	35	44	59	ab
Total	1583	18	23	25	29	74	

Minimum and maximum values represent the complete range of ages within regions. First quartile and third quartile statistics demonstrate the interquartile ranges of ages within regions. Significance between regions is demonstrated as compact letter display. The significant difference between groups was determined as $P < 0.001$. Min: minimum; Max: maximum; CLD: compact letter display.

Table 2. Tabular description of enrolled trainees' fields and disciplines of study or work

Field	Discipline	*n*	Percentage	Field	Discipline	*n*	Percentage
Health	Veterinary	478	30.2	Science	Biology	195	12.3
	Bio/medicine	192	12.1		Environmental	24	1.5
	Public Health	139	8.8		Animal Science	18	1.1
	Pharmacy	76	4.8		Agriculture	10	0.6
	One Health	23	1.5		Total	247	15.5
	Dentistry	14	0.9	Humanities	Literature	60	3.8
	Total	922	58.3		Education	30	1.9
					Psychology	12	0.8
					Law/Politics	10	0.6
Other	Total	302	19.1		Total	112	7.1

Trainee disciplines are grouped according to their most affiliated field. Some trainees associated with multiple fields or disciplines.

Since the survey was voluntary and anonymous, the number of respondents could not be controlled. Each respondent answered one of five levels on a Likert scale before and after training ranging from no confidence (1) to very confident (5) in response to the questions: (A) "How comfortable are you with teaching 10-year-old students?"; (B) "How would you rate your overall science communication skills?"; and (C) "How would you rate your current overall teaching skills?".

Responses for question A, concerning confidence in teaching 10-year-old students, were significantly different ($P = 0.001$) before and after training, where responses for no, low, or neutral confidence levels (1-3) decreased, and responses for somewhat or very confident (4-5) reciprocally increased [Figure 4A]. The mean confidence level of 3.9 before training increased to 4.2 after training, an increase of 0.3 scale points after the intervention, indicating that the orientation training significantly improved participant confidence in teaching novice audiences such as 10-year-old students.

Responses for question B, regarding overall scientific communication skills, were significantly different ($P = 0.0097$) before and after training, where response categories decreased and increased the same as for question A [Figure 4B]. The mean confidence level of 3.9 before training increased to 4.0 after training, an

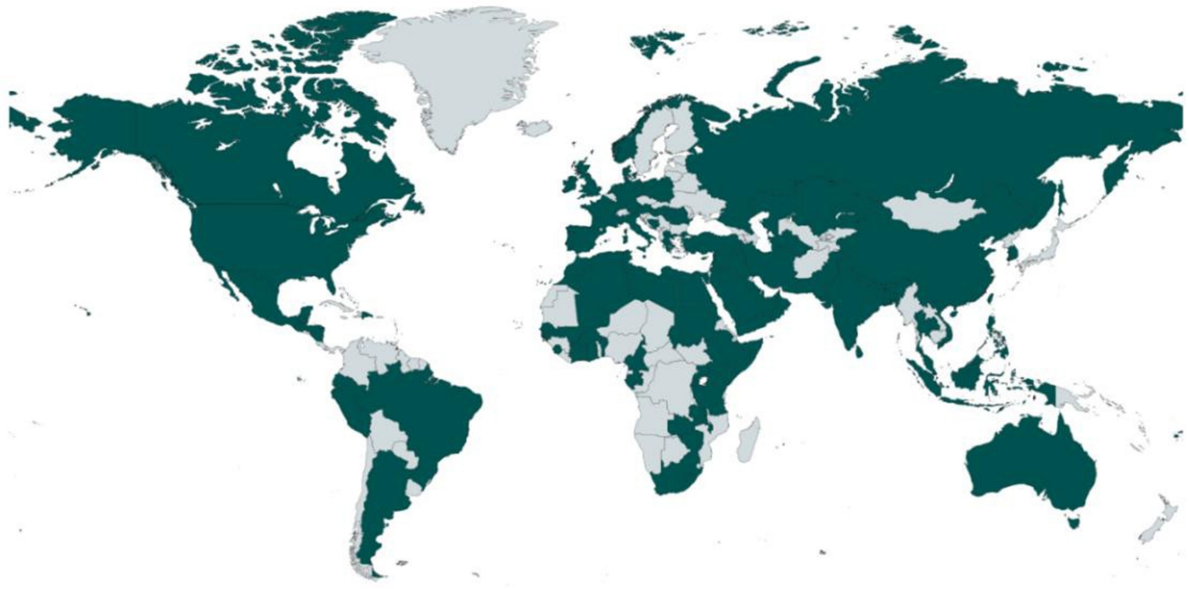

Figure 3. Geographical projection of national identities represented by the survey participants. Nationalities represented by enrolled Certified Lesson Leader Program (CLLP) trainees are highlighted in dark green. Created with Mapchart.net.

increase of 0.1 scale points after the intervention, indicating that the OHL orientation training significantly improved participant confidence in their science communication skills.

Responses for question C, concerning overall teaching skills, were significantly different ($P = 0.003$) before and after training, where response categories decreased and increased the same as for questions A and B [Figure 4C]. The mean confidence level of 3.6 before training increased to 3.8 after training, an increase of 0.2 scale points after the intervention, indicating that the orientation training significantly improved trainee confidence in teaching overall.

Participants were asked about their age when first inspired to pursue their STEMM career [Figure 5]. Only two respondents abstained from answering the question because they did not consider themselves in a STEMM field. For this answer, trainee responses were grouped as early childhood and primary school (< 12 years old), secondary school (12-17 years old), young adulthood (18-24 years old), early-career stage adults (25-34 years old), mid-career stage adults (35-44 years old), and late-career stage adults (> 45 years old). Each panel shows a breakdown of the responses into these groupings. Any responses for intermediate numbers (i.e., decimal figures) were rounded to the appropriate year. The majority (80.4%) of trainees reported they had first considered their current career while in primary or secondary school (39.3% and 41.1%, respectively). The median age at which participants were first inspired towards their careers was 13 years old, 95%CI [4.00, 21.95].

Surveying of full-time classroom teachers

Full-time classroom teachers who observed CLLP trainees teach a lesson about OH to their students were surveyed for their classroom demographics, student ages, and degree of student engagement, as well as the effectiveness of the OH lessons in inspiring interest in science, and the teachers' inclination to continue teaching about One Health and purchasing OHL content [Table 3 and Supplementary Material 2]. This survey was optional and the teachers remained anonymous.

Table 3. Tabular description of enrolled trainee's classroom demographics, student engagement, and effectiveness in promoting science and internal promotion of One Health teaching

Teacher survey response		Number (*n*)	Percentage
Classroom student demographic	Mostly low-income families	47	25.5
	Mostly minority	39	21.2
	Mostly female	33	17.9
	Mostly English learners	1	0.5
	None of these	32	17.4
	Unknown	67	36.4
Classroom age range (years old)	5-8	11	6.0
	8-10	51	27.7
	10-12	23	12.5
	12-14	14	7.6
	14-16	8	4.3
	16-18	8	4.3
	18+	5	2.7
	Unknown	64	34.8
Percentage of classroom engagement	< 30%	14	7.6
	30-50%	22	12.0
	51-75%	24	13.0
	76-90%	19	10.3
	91-95%	14	7.6
	> 95%	23	12.5
	Unknown	68	37.0
Level of student interest in OH lesson	Minimum	0	
[1 = no interest, 10 = very interested]	First quartile (25%)	7.3	
	Median	9	
	Third quartile (75%)	10	
	Maximum	10	
Effectiveness of OH lesson to increase	None at all	1	0.5
student interest in science	A little	3	1.6
	A moderate amount	22	12.0
	A lot	45	24.5
	A great deal	45	24.5
	Unknown	68	37.0

For categorical variables, responses are represented as percentages (%) of the total 184 teachers/classrooms. For ordinal variables, responses are represented as quartile values of the total responses.

Of the participating 184 taught classrooms, notable proportions were composed of students mostly from low-income families (25.5%), minority ethnicity backgrounds (21.2%), mostly female students (17.9%) or English learners (0.5%) with much overlap, accounting for 84 (45.7%) classrooms featuring a disadvantaged educational group. The largest age groups taught proportionally were the ranges of 8-10 (27.7%) and 10-12 (12.5%) years old, with the remaining age groups each constituting less than 10% each. Regarding classroom engagement during the OH lesson (e.g., answering, asking questions, participating in activities), 68.8% of responding classroom teachers reported that at least 51% of their classroom participated in the OH lesson, while 37 of the 116 (31.8%) question respondents reported at least 91% engagement. Student interest in the OH lesson was high according to their teachers, with a median of 9 out of 10, and 50% of values falling between "fairly interested" (7.3) and "very interested" (10). 112 out of 116 (96.6%) responding teachers reported that their students demonstrated at least "a moderate amount" of increased interest in science after the OH lesson was delivered by the OHL trainee.

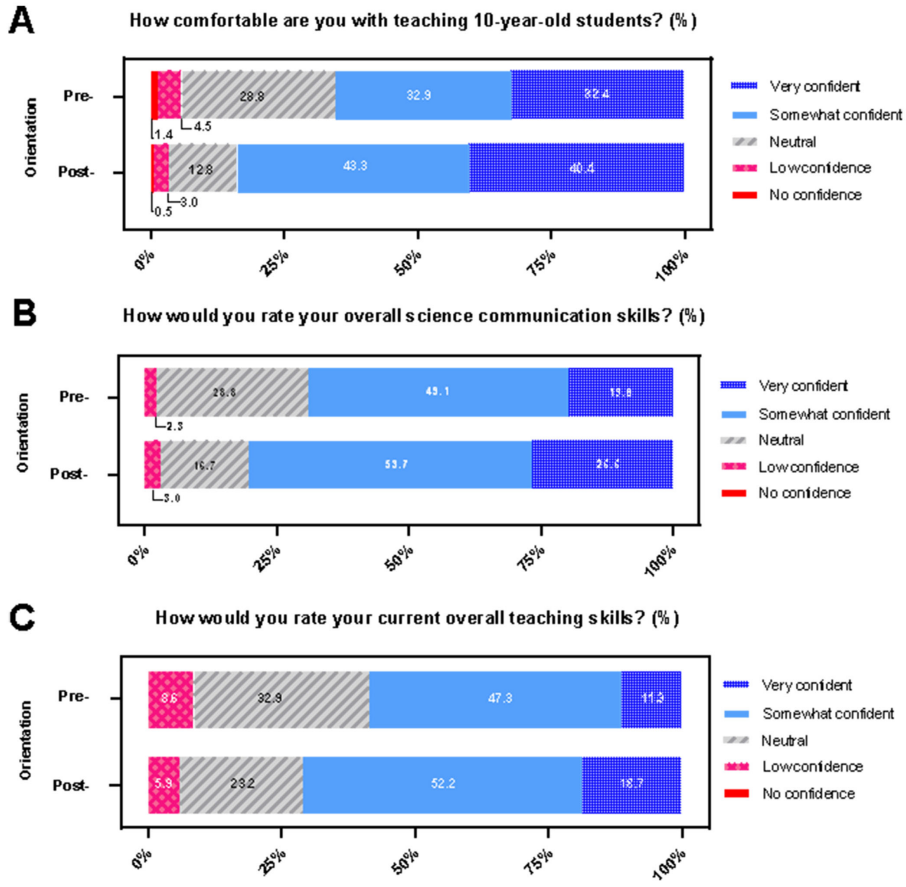

Figure 4. Pre- and post-orientation survey responses of trainees' self-ascribed confidence in (A) teaching and (B) science communication to young audiences, and (C) overall teaching skills. Scaled responses are represented as proportions of bar graphs with exact percentage of response indicated within.

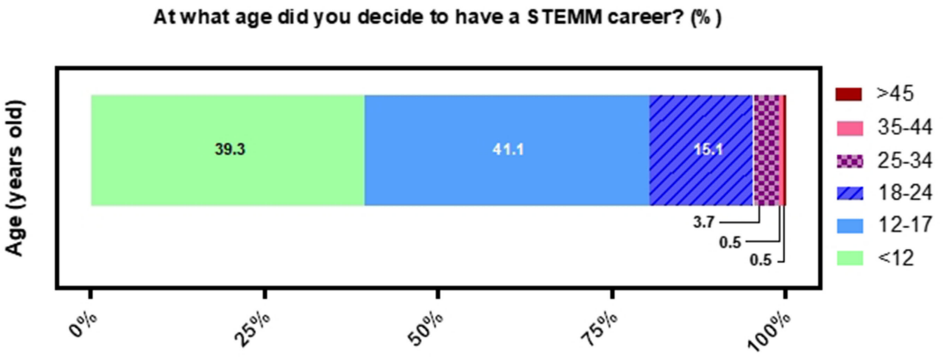

Figure 5. Trainees indicate their age when first inspired to pursue a Science, Technology, Engineering, or Mathematics, including Medicine of all forms (STEMM) career. Responses were clustered into determinate age categories and are represented as proportions of bar graphs with exact percentage of response indicated within.

Teachers were also queried for their inclination to recommend lessons about OH to their educational colleagues, continue teaching OH, and consider purchasing supplemental OH teaching material [Figure 6]. Each panel in the figure shows a breakdown of the responses into these levels of confidence. To these questions, participants responded overwhelmingly that they would recommend their colleagues teach the OH lesson (97.4%) and they themselves would want to continue teaching OH in their own classrooms (90.8%). Further, the majority of teachers considered purchasing supplementary OH materials, either individually (20.2%) or with the support of their institutions (36.1%). Those teachers who selected that they would not purchase OH materials often cited various reasons, including (1) having limited funds; (2) limited time and energy spent on extra-curricular learning due to pressures on local standardized tests for students; and (3) impending retirement. In addition, the teacher survey found that the OH lesson taught virtually in 184 classrooms had a median student interest of 9 out of 10 [Table 3]. From this, it appears that the OHL Program boosted active engagement and interest in OH among trainees, observing teachers, and students alike.

DISCUSSION

The Quadripartite's OH infographic [Figure 1] prominently features communication as an essential skill[4]. Similarly, updated OH core competencies agree and emphasize the importance of public speaking[6]. To apply OH from theory to action, a OH unit must be able to communicate efficiently between team members

and with community stakeholders to be better prepared to prevent, predict, detect, and respond to global health security threats.

The global TTP of OHL has demonstrated perceived improvements in communication skills and has demonstrated the impact of trainees with novice audiences at the community level. Early career professionals were strongly represented across all regions [Table 1], with 50% of all participants aged between 23 and 29 years old, despite minor differences between regions. Given the underrepresentation from Central America and Oceania regions (ab), accounting for 4 and 12 participants, respectively, and the lack of an independent cluster, it is hard to conclude that the regions within a and b clusters have significantly different participant ages. Greater representation from Oceania and Central America could delineate or consolidate such clustering. Regardless, keen participation from early career professionals in teaching OH principles across all regions reflects the propagated interest of young professionals to engage communities in OH efforts.

A substantial portion of enrolled CLLP trainees represent health fields, with veterinary students or professionals accounting for 30.2% of the total participants [Table 2]. Despite best efforts to expand interest in OH beyond the veterinary discipline, participation from other key sectors such as human medicine and environmental sciences remains low (12.1% and 1.5%, respectively). Given the largely veterinary history, propagation, and championing of OH concepts, this is unsurprising and the overrepresentation of veterinary professionals in OH will likely continue given the emergent nature of OH in wider public knowledge, including public policy. However, the garnered awareness from lateral fields is of interest, because each discipline offers a new perspective to the holistic OH approach, even minimally. The authors endorse and support further inclusion and promotion of OH in communities outside of veterinary medicine.

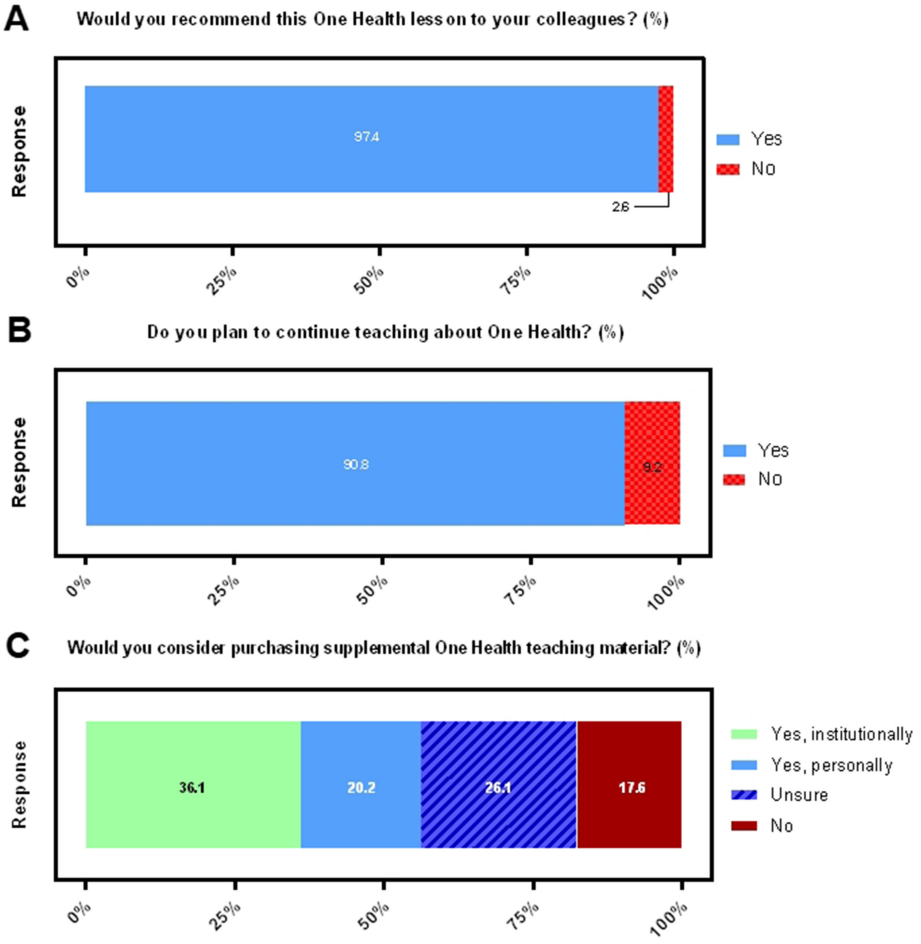

Figure 6. Survey responses of full-time classroom teachers. Each panel shows a breakdown of the responses into the different levels of confidence in recommending OHLs (A), continuing One Health education (B), and purchasing supplemental One Health Lessons (OHL) material (C).

The improvements observed in trainee confidence in regards to teaching young classes, scientific communication, and overall teaching are notable, with the responses of 'somewhat confident' or 'very confident' being garnered more so after OHL training [Figure 4]. All CLLP trainees were OH advocates prior to volunteering with OHL; their backgrounds, with the exception of two individuals as previously stated, are affiliated with only STEMM or in combination with another field such as education or literature. As such, their experience communicating complex topics to primary school students is minimal. The CLLP provided both training in OH communication and implementation of learned skills of trainees at the community level. Communication is a skill that must be practiced and the most efficient method of practicing is with audiences that are not familiar with the subject matter (a novice audience)[5].

Not only can trainees benefit from practicing public speaking in classrooms with a novice audience, but the classroom students and associated teachers may benefit as well. This study found that the majority (80.4%) of trainees first considered their current STEMM career while in primary or secondary school, with a median age of 13. This finding is in agreement with another study that noted children around 10-12 years old start to consider their future career[10], notably at the intersection of primary and secondary schools

where class selection and specification commences. Today, there is growing recognition of the need to educate youth in OH prior to entering university to increase awareness and potential future involvement in OH activities[11]. However, the OH term tends to be only introduced in tertiary school or later[12]. The potential of raising awareness of OH within this impressionable age group is outstanding, given that the students can pursue any field or discipline yet remain OH advocates. In addition, through early exposure to the OH approach, students may want to seek out future opportunities to work collaboratively with others across different backgrounds and disciplines to dissect and tackle complex global health issues. Therefore, we encourage more efforts to teach OH to children in primary and secondary school to increase understanding, support and participation in OH efforts in the near future at the community level[5,7,13]. Awareness of OH at an early age, regardless of the career discipline committed to, only reinforces the spectrum of involvement and varied approaches to OH.

During this study's duration, the vast majority of visited classrooms were taught virtually and were in primary schools found in underserved areas[7,8]. A distinct proportion of teachers (68.8%) who responded to the question concerning the percentage of student engagement reported that more than half their students actively participated in the virtual lesson [Table 3]. Given constraints in student learning during the COVID-19 pandemic, this percentage was surprisingly high. The full-time classroom teachers often mentioned that they saw an added benefit of having a CLLP trainee from another country teach their students in the classroom virtually, which increased their students' interest in different cultures, languages, and geography[9]. In addition, 112 out of 116 (96.6%) full-time teachers who responded to the question of "How effective was this One Health lesson in getting your students further interested in science?" noted that the single OH lesson increased their students' interest in science by at least "a moderate amount", and 99.1% indicated at least "a little". Other features of interest were the large participation of classes with systemically underserved students, being a majority from low-income families, ethnic minorities, female, or non-English speaking. The authors attribute this to the fact that the partner organization, CRS, focuses on bringing scientists into schools in underserved communities. Given the aforementioned interest and enthusiasm of students of OH teachings, this study's findings emphasize both the need and enthusiasm for developing and implementing OH teaching for all classes and communities, regardless of their advantaged or disadvantaged status.

Importantly, after a OH lesson was taught by a CLLP trainee, a large percentage of full-time teachers expressed interest in acting to further promote OH in their community by either: (1) recommending the OH lesson be taught in other classrooms (97.4%); (2) continuing to teach about OH by imbedding it into their future course material (90.8%); or (3) having purchased more OHL learning material available to their classroom (56.3%) [Figure 6]. The teachers who responded that they would not continue teaching about OH cited logistical problems such as impending retirement or their limited time to commit to an extra-curricular subject due to pressures on local standardized tests for students. The authors suggest a clear solution to the latter problem: build OH questions into such standardized tests. It is clear that classroom teachers must focus their time to meet the needs of their school administrators as well as their students. By infusing OH into such standardized tests, the teachers would then need to teach about OH. This study has found that after the CLLP trainee has communicated OH efficiently, there is great teacher interest to continue teaching their students about OH, but external barriers limit exploring this.

The majority of this study's novice audiences were students and their teachers in primary school classrooms. The trainees were challenged to teach OH topics to an audience that had relatively simple vocabulary and a general lack of advanced science knowledge. This served four purposes that affected the trainee and the community: (1) the trainee was forced to efficiently speak on OH while staying highly-

engaged to not lose the relatively short attention of the children, especially by teaching virtually; (2) the students in the classroom were educated about the OH *concept* and *approach* at an early age, which could influence their appreciation for the interconnection between their health and the health of the environment, animals and plants and may impact their immediate actions on the environment; (3) the live and active teachings made OH more accessible and attractive to students, causing the trainees to be seen as relatable OH role models; and (4) the classroom's full-time teacher learned about OH and could then incorporate the theme of OH into future lessons with their current class and future groups of students.

Overall, the TTP affiliated with OHL was a success for both OH advocate trainees and communities. The trainees improved their communication abilities through education and public speaking, a vital transferrable skill that can be utilized throughout their chosen careers, while the communities were engaged at the classroom level, inspiring students and their teachers around the world to value OH. Together, this demonstrates the potential of the program to not only train the young generation of OH professionals and communicators, but also to broadly encourage studies in STEMM and interdisciplinary collaboration, and bolster student and teacher engagement with OH efforts.

CONCLUSION

The idea of OH is foreign to most parts of the world and remains remarkably absent in the critical early years of education. It is the responsibility of OH educators to actively train the current and aspiring OH workforce to be proficient in public speaking with novice audiences, community engagement, and communication in general to protect communities from complex threats to health. Based on the positive impact of the study's TTP on both the trainees and communities, the authors encourage two methods to improve OH communication and community involvement in OH efforts: (1) teach OH communication to the current and aspiring OH workforce in a manner that requires trainees to frequently practice public speaking to novice audiences, such as was demonstrated with the OHL TTP, and (2) accept broad incorporation of the OH theme throughout primary and secondary school curricula to educate the next generation of leaders about OH.

DECLARATIONS

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Authors' contributions

Designed the study and wrote the draft: Thomson DJ, Ma D
Recruited and surveyed participants: Thomson DJ, Ma D
Analyzed and interpreted the data: Lennard PR, Ferri M
All authors added their contributions and comments and approved the final version of the manuscript.

Availability of data and materials

The primary author can provide data, if requested, per the policy of the private non-profit organization.

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None.

Conflicts of interest

Thomson DJ and Ma D are affiliated with One Health Lessons.

Ma D has received funding to support her independent contract work with One Health Lessons.
All other authors have not received any monetary funds from One Health Lessons and declare that there are no conflicts of interest.

Ethical approval and consent to participate

All methods performed in this study were in accordance with the ethical standards of the Declaration of Helsinki. The data was collected anonymously and voluntarily from participants. The findings have been presented in the form of anonymized participant data. No subject identifiers were used during any survey that contributed to this manuscript.

Consent for publication

By signing up to be a Lesson Leader, demographic information (without identification of the individual) may be used for future evaluation and analysis of the Program.

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